SCIENCE

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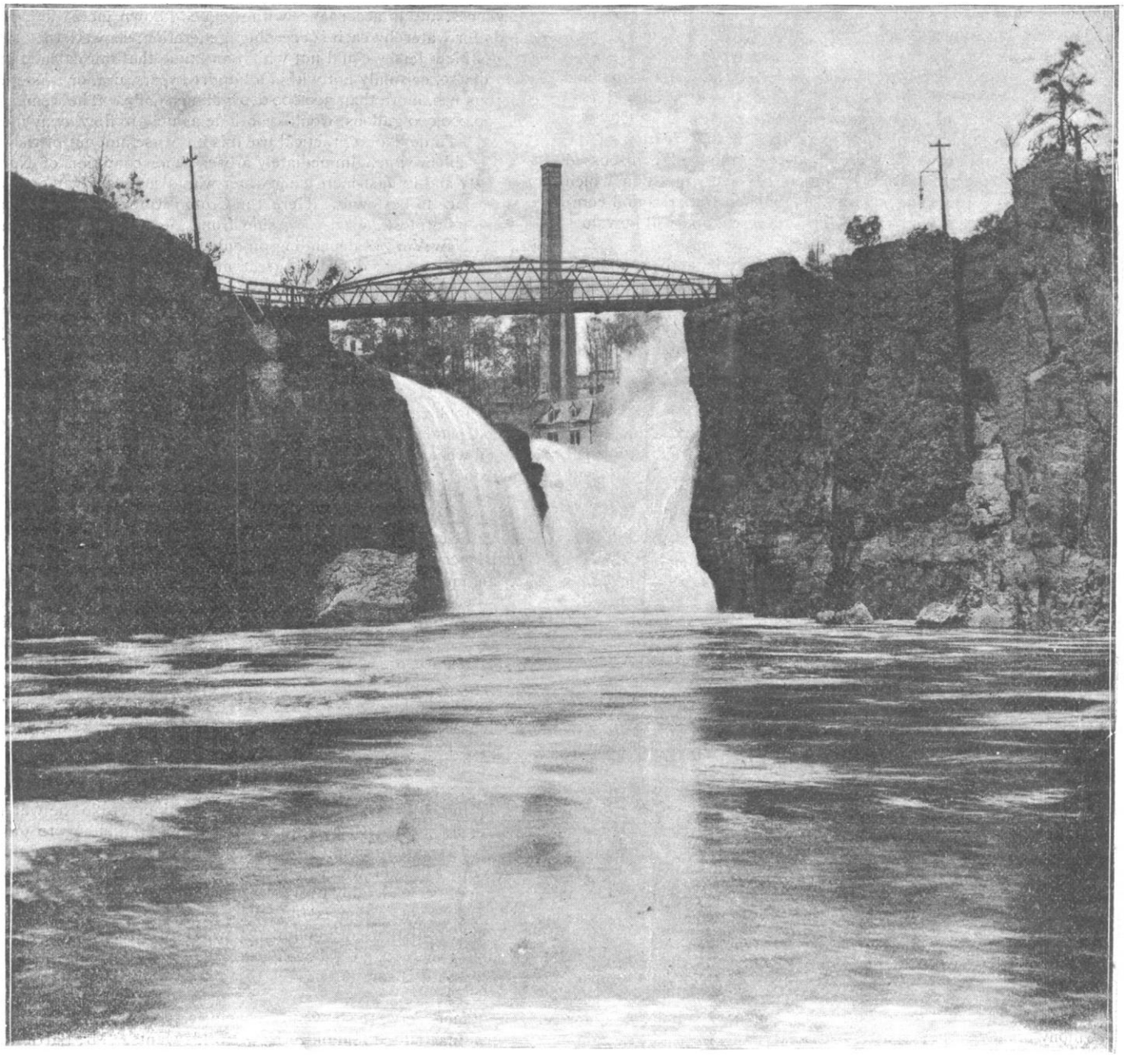


THE GREAT FALLS. ON THE PASSAIC RIVER, IN PATERSON, N.J., 15 MILES FROM NEW YORK, SHOWING WASTE OF WATER INTO THE SEA. [See p. 208.]

THE WATER PROBLEM OF NEW YORK.

THE water problem before the city of New York, how to meet the increasing demands of the vast and fast-growing population for water for domestic use, sanitary purposes, and for the requirements of commerce and manufacture, has been answered by Mr. John R. Bartlett. While engineers and politicians have been speculating with the limited possibilities of the Croton watershed, and with visionary plans for diverting the waters of the upper Ramapo River, and for getting an additional supply from the Adirondacks or Lake Erie, and have reduced to despair sanitarians and all others acquainted with the really critical condition of the city's affairs on the water question, Mr. Bartlett has been quietly maturing plans which meet the emergency practically and conclusively. He offers to furnish the city with not less than 50,000,000 gallons of pure water daily, under a head pressure of three hundred feet. He and associates have the water to sell, the unquestioned right to sell it, and will pour it into the city ready for use without demanding of the city a single dollar before the water has been delivered.

These plans have been recently presented to the sinking-fund commissioners of the city, and are elaborately set forth in a folio volume of a hundred and seventeen pages. The water is to come from the Passaic watershed, situated in the States of New Jersey and New York; and the quantity supplied to New York City will not more than equal the amount of rainfall in that portion of the watershed which lies in New York State. In the book is discussed every phase of the problem. It anticipates every question which the extent of the plans suggests, and abounds in statistics and comparative calculations which show deep research, and will be valuable for reference for all cities.

In order to properly appreciate the magnitude and the beneficence of this project, an outline of its inception and progress is necessary. The data which follow are furnished by Mr. Bartlett's book and the recent well-known history of New Jersey. They tell a story of successful enterprise, on whose completion the State of New Jersey and the entire metropolitan district are to be profoundly congratulated.

Mr. Bartlett first directed his attention to the crying demand for pure water raised by the cities and towns east of the Orange Mountains in New Jersey. Newark and Jersey City, the chief municipal centres of this region, and incidentally the suburban and adjacent towns, had been agitating the question for years. Official inquiries of engineers and health-officers instituted by these plans had evoked on each occasion the startling result that the water furnished their people was unfit for use, and was a constant menace to the health of the communities. The various examinations showed a steadily increasing danger. This was made manifestly logical and necessary by the fact that the water for this region was taken from the lower Passaic River, a tidal stream, and at a point in the river where the pollution from the fast-growing cities and increasing factories was all deposited.

The only remedy lay in getting water from a source above the point of pollution. The State was manifestly helpless, because of its inability to legislate to any particular locality rights to which all places had a just claim; nor could it attempt a general relief, because of the immense amount of money which would be required to pay for the condemned land and the taking-away of individual rights. Even if this should be accomplished by a vote of the people of the State, other serious constitutional objections interposed, and difficulties of a practical and business nature which were well-nigh insurmountable. The helplessness of the cities themselves was even more pronounced, as added to the State's difficulties were individual indebtedness and political imbroglios, which have been fully ventilated during the last year.

A unification of all interests was essential, — a harmony of action on the part of all the water companies and corporations having rights below the point designed for the source of supply, a similar harmony of all riparian owners, and a harmony of all legal rights to the water, — in fact, a condition was essential which seemed beyond the reasonable power of human energy to bring about, and this is the condition which Mr. Bartlett has successfully worked out.

The detailed story of how the history of this entire section, from its original granting to the present time, was mastered, in order to ascertain beyond peradventure the absolute rights of every claimant; how the records of judicial action during this time were all consulted to justify these rights; how the engineering problems, as many as anticipation of any diverse plans might ever involve, were all solved; how the legal aspect of every phase of the work was fully understood at each step; how the immense business manipulations of purchasing the many acres of property and satisfying all owners were accomplished, — how all these things were done will be an interesting chapter of a future history of New Jersey. Suffice it here to note with amazement and pride that it all has been done.

The immense Passaic watershed of the States of New Jersey and New York was at command, and the water was ready to be poured into the houses of the long-suffering people. Here developed the most interesting phase of the project. The extent of the watershed is about 877 square miles. The average daily capacity is 700,000,000 gallons. A computation based on the most generous allowances, and in accordance with the well-known increasing demands for water by each succeeding generation, showed that the State of New Jersey could not within any time that fair calculation could devise, certainly not within a hundred years, use, or waste in generous use, more than 300,000,000 gallons daily. The remainder, 400,000,000 gallons, would continue as now to flow away into the sea. To devote to practical use this immense amount of water was a problem which immediately arose. The condition of New York City and its fast-increasing water wants suggested at once a proper place to bestow it. Here the Croton watershed was being taxed to its utmost capacity. Aside from the danger to a great city like New York of depending on only one source of supply for water, — a danger which all great municipalities recognize and guard against to the utmost limit, — this source was showing evidence of soon becoming insufficient to supply the requisite amount of water. Its whole capacity, with Quaker Bridge dam and every other storing contrivance utilized, would be only 250,000,000 gallons daily. To estimate the future by the records of the past, within ten years the wants of the people of New York City could not be supplied.

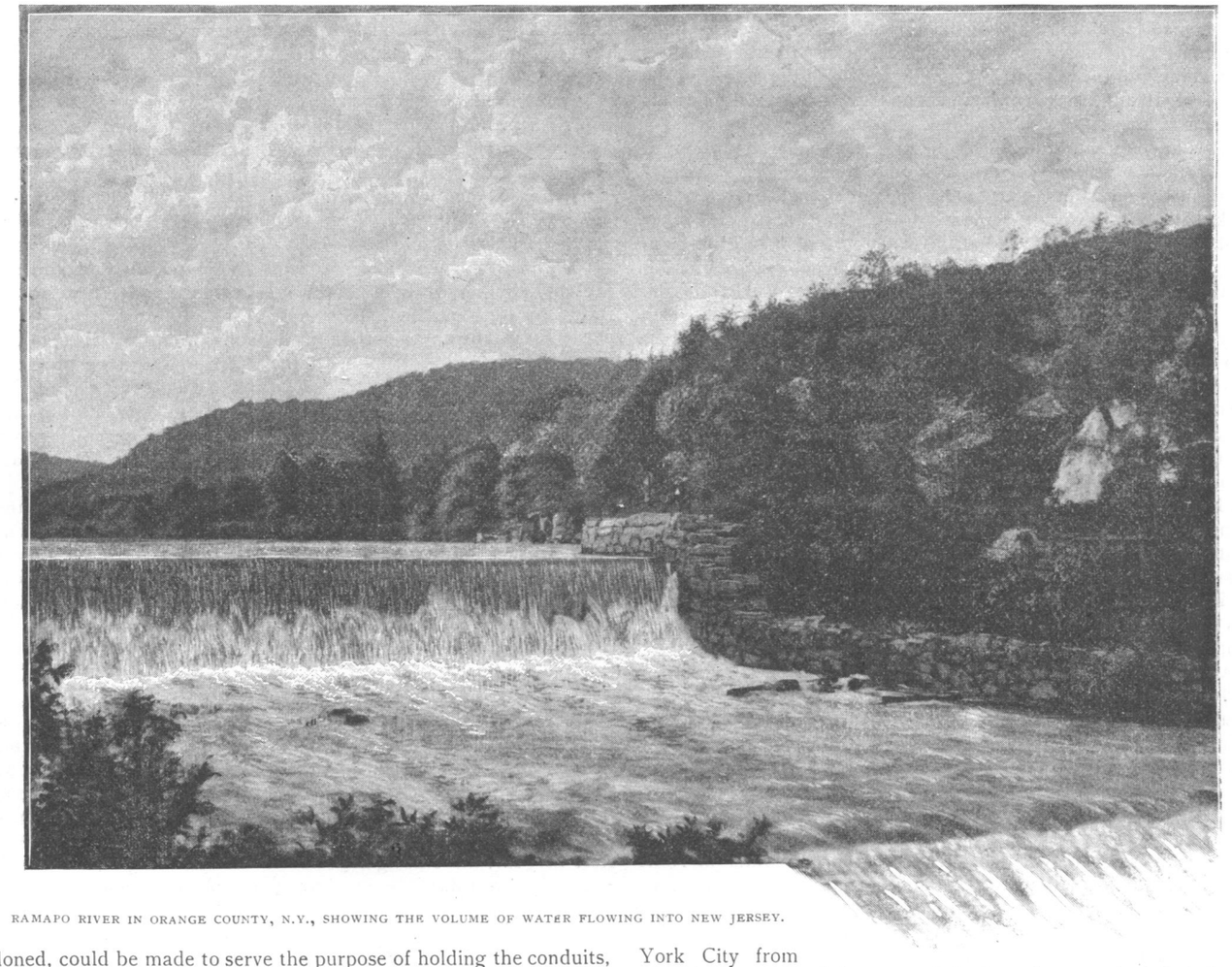
The dependence on a bountiful supply of water of a city's progress and welfare is so well known that it need not be argued. It is an axiom. In small towns, where the chief consumption is confined to the direct uses of the inhabitants, the amount of water used *per capita* can be small; but in a large municipality people are not the only consumers. The onward march of steam, and the various succeeding inventions of civilization, have rendered necessary an immense amount of water for their assistance. Large cities, therefore, have this quantity included in the *per capita* use of water; and, besides the other considerations of better health and greater security, a larger *per capita* use of water indicates an advanced state of prosperity. A ridiculous argument has been used in New York against increasing the water-supply. "Let the waste of water be stopped," it said: "we are using too much." The fact is, that a generous use of water could not be indulged without a generous waste. The permanent necessity of the former renders the latter not an evil, but a desirable condition. Moreover, statistics show that the ratio of increase of population does not in any degree determine the ratio of increase in the water wants of a city; because, whereas in a small community 10 gallons daily *per capita* might be sufficient, in a large community the various other uses of water mentioned above would render the *per capita* needs considerably over 50 gallons.

A striking illustration is furnished by the city of Philadelphia, where in 1810 they used 7 gallons of water *per capita;* in 1830, 17 gallons; in 1860, 36 gallons; in 1880, 68 gallons; in 1886, 80 gallons; and it is said the figures of this year will show 100 gallons.

These facts serve to show more conclusively the imminent necessity for immediate attention to New York's wants. Mr. Bartlett's efforts had brought an available quantity of water from a pure source to the opposite banks of the Hudson, where he was confronted with a new series of problems, legal and mechanical. He meets all the questions as to the right to bring the water through and out of the State of New Jersey with opinions giving specific

and unqualified indorsement from ex-Chancellor Benjamin Williamson, ex-Gov. J. D. Bedle, ex-Gov. Leon Abbett, Henry C. Pitney, Garret A. Hobart, A. Q. Keasbey, William Pennington, Henry C. Andrews, ex-Chancellor Theodore Runyon, Barker Gummere, and decisions of the courts of last resort of both States. Thus arrayed, is the best legal talent in New Jersey.

The formidable task of crossing the Hudson with absolute confidence, he also solved, and in a most remarkable manner. Instead of presuming on a plausible theory, many of which abound, Mr. Bartlett set to work on the best theory, and worked it out at a cost of nearly $200,000. This was done for the purpose of ascertaining whether a certain opinion he held was correct or not. His opinion was that the Hudson River Tunnel, at that time practically abandoned, could be made to serve the purpose of holding the conduits, the great water-mains. In this way he built a large section of the tunnel from the New Jersey end, and the fact was thoroughly demonstrated that the rest could be built the same way, and that the water-way was secure.



RAMAPO RIVER IN ORANGE COUNTY, N.Y., SHOWING THE VOLUME OF WATER FLOWING INTO NEW JERSEY.

Accompanying the proposition of Mr. Bartlett and his associates is an indorsement, confirming all that Mr. Bartlett says of his project and its possibilities, by all the companies or societies which have any controlling water-rights below the point of diversion in the State. These are the Society for Establishing Useful Manufactures, the Lehigh Valley Railroad Company, the Dundee Water Power and Land Company, the Acquackanonk Water Company, the West Milford Storage Company, and the Montclair Water Company.

A committee appointed by the New York Board of Fire Underwriters to examine into the merits of Mr. Bartlett's plan reported that in their judgment the plan was feasible, and, if adopted, would be of great benefit to the city, and was entitled to the support and indorsement of the underwriters, and to the favorable consideration of the city government. Upon receipt of the report, the board passed a resolution authorizing the committee "to recommend Mr. Bartlett's proposition to the favorable consideration of the commissioners of the sinking-fund, and urge upon them the adoption by the city of the proposition in accordance with the plans submitted, in order to secure to the city an adequate supply of water for all purposes, and to meet its present needs, and that the same be done as promptly as possible."

A board of engineers, composed of Clemens Herschel, A. Fteley, and Capt. T. W. Symons, U.S.A., carefully examined the plans of Mr. Bartlett, and made a report as follows: "We do recommend as an entirely practicable and valuable project the general plan which has been submitted by you for supplying a portion of New York City from the drainage area of that part of the Passaic watershed that lies in the State of New York, and in the manner herein described, including the use of a tunnel under the Hudson River for carrying the necessary water-conduits across the river in a safe, durable, and trustworthy manner. We summarize its principal advantages as follows: 1. It will furnish to the city of New York an independent supply of water from a new and independent source and by a new and independent route; 2. This supply will be delivered directly into those portions of the city most remote from the present source, and where the pressure is most inadequate; 3. It can be delivered under any pressure desired, up to three hundred and fifty feet of head, and supply all high buildings and districts without pumping, thus resulting in a great saving to individuals; 4. It will furnish most perfect fire protection, and consequently greatly reduce the cost of insurance."

A memorial of fire-underwriters to the commissioners of the sinking-fund of New York, upon this subject, signed by the officers of all the fire-insurance companies in the city, concludes as follows: —

"The proposed method of projecting water upon fires would greatly reduce the cost of that service as administered at present, and at the same time vastly add to the efficiency of the means of extinguishing by the application of water. First, it would enable a few men with a light hose-carriage to reach the point of fire much quicker than the present heavy engines to-day; and at the breaking-out of a fire a minute is sometimes worth a million dollars, and frequently a hundred thousand. Second, it would enable the firemen, by the use of permanent stand-pipes, to connect short lengths of hose, and apply the water in large streams and solid masses; whereas at present, even when two or three engines are forcing water through a single pipe, or tower, the stream is largely converted into spray before it reaches the fire, and is then converted into steam, and even into a gas that aids combustion rather than stops it."

The medical authorities and health-officers of this city have given this plan much careful consideration, and their conclusions are favorable to the project. Mr. James C. Bayles, president of the Board of Health, in a communication to Mr. Bartlett, gives his views as follows: —

"It is undoubtedly true that at the present time large portions of New York are very inadequately supplied with water. This department has constant and serious trouble in that branch of its work which deals with the plans of tenement-houses and other dwellings, owing to the fact that the available supply of water is in many cases so small as to forbid a proper cleansing of plumbing fixtures, if these are provided. There are large districts of the city where the pressure rarely carries the water above the first story; and in the case of tenement-houses, divided into many apartments, each apartment must be provided with one or more pumps, which, finding their supply from the three-fourths-inch tap at the street-main, are not always able to lift the water required for domestic use. A good water-supply, abundant in quantity and excellent in quality, is a condition precedent to the healthfulness of a community. This is especially true of a crowded community like New York. I am of the opinion that no one thing would do so much to facilitate and make effectual the work of this department as a great and immediate increase in the water-supply, under pressure sufficient to reach the upper stories.

"I am unable to favor, from a sanitary point of view, the measures which have been suggested, looking to a restriction of consumption in order to prevent the present admitted large waste. A liberal use of water accomplishes what can be attained in no other way, — the cleansing of pipes and sewers; and people who have access to all the water they desire and can use, are likely to be cleaner in their homes and persons than those who suffer restrictions in this most important item of daily consumption. I do not think the sanitary aspects of the question with which we are now confronted, growing out of an admitted scarcity of water in New York, can be exaggerated.

"An increased supply and better distribution of water in New York would undoubtedly tend to diminish the number of contagious and infectious diseases with which we now have to deal, and would produce a marked improvement in the public health. If it were not for its peculiar position as the gateway of this continent, to which more than eighty per cent of the inflowing travel and immigration tends, our death-rate would not be so large as it is. For example: if the deaths among immigrants who have never become a part of our population could be eliminated from our totals, we should last year have reduced the death-rate per thousand from twenty-four or twenty-five to twenty-two. If, further, we could avoid the overcrowding of Italian and other impoverished immigrants in our tenement-house districts, our death-rate would compare favorably with that of the most healthful city of the world.

"It will not do, however, to attach too much importance to these hopeful figures. They are liable at any time to be changed, and nothing will tend so quickly and effectually to change them as a failure in the water-supply of the city. Of the dangers to which this is subjected, I do not need to tell you.

"Answering your question with reference to the effect which an increased water-supply would have in diminishing the number of malignant diseases of a contagious or infectious type, I regret that I am unable to be specific. This, of course, is largely a matter of opinion, but it is an interesting fact that a very large proportion of the cases of contagious and infectious disease which come under the care of the Board of Health are taken from the upper floors of tenement-houses. Whether this is due to lack of water, which is greatest on the upper floors, or to impurities in the water which rise to about that level, I am unable to say. I believe, however, that a material increase of the city's water-supply would promptly and permanently reduce the public burdens entailed in the care of the city's sick.

"The cordial sympathy and co-operation of this department would be extended to any practicable scheme looking to a supply of water for New York from other sources than the Croton watershed. Our city is growing with great rapidity, especially in the 23d and 24th wards, north of the Harlem River. It is probable that the needs of this district will not be more than met by the increased supply to be obtained through the new aqueduct, when all the engineering work looking to the impounding of additional water is completed."

If more need be said upon the subject from a sanitary standpoint, it is furnished by the following preambles and resolutions adopted by the Medical Society of the State of New York at a meeting held Sept. 24, 1888: —

"*Whereas* the present scarcity of water in this city is causing great inconvenience as well as serious apprehension for sanitary and other reasons; and

"*Whereas* the new aqueduct will not materially increase the present supply from the Croton watershed until after the storage-reservoirs are completed, six or more years from now; and

"*Whereas* the upper portion of the city, with its rapidly growing population, will soon require all the water that can be procured from that source; and

"*Whereas* the present insufficient supply of water is a constant menace to the health and safety of the city, inviting scarlet-fever, diphtheria, cholera, and other malignant diseases, as well as disastrous conflagrations: therefore be it

"*Resolved* that this society has listened to the explanation of the plans proposed by John R. Bartlett, Esq., for furnishing the city of New York with an additional supply of pure water, from a source independent of the Croton watershed, and that it approves the same, and urgently recommends it to the attention of the city authorities having such matters in charge."

PRUNES IN FRANCE.

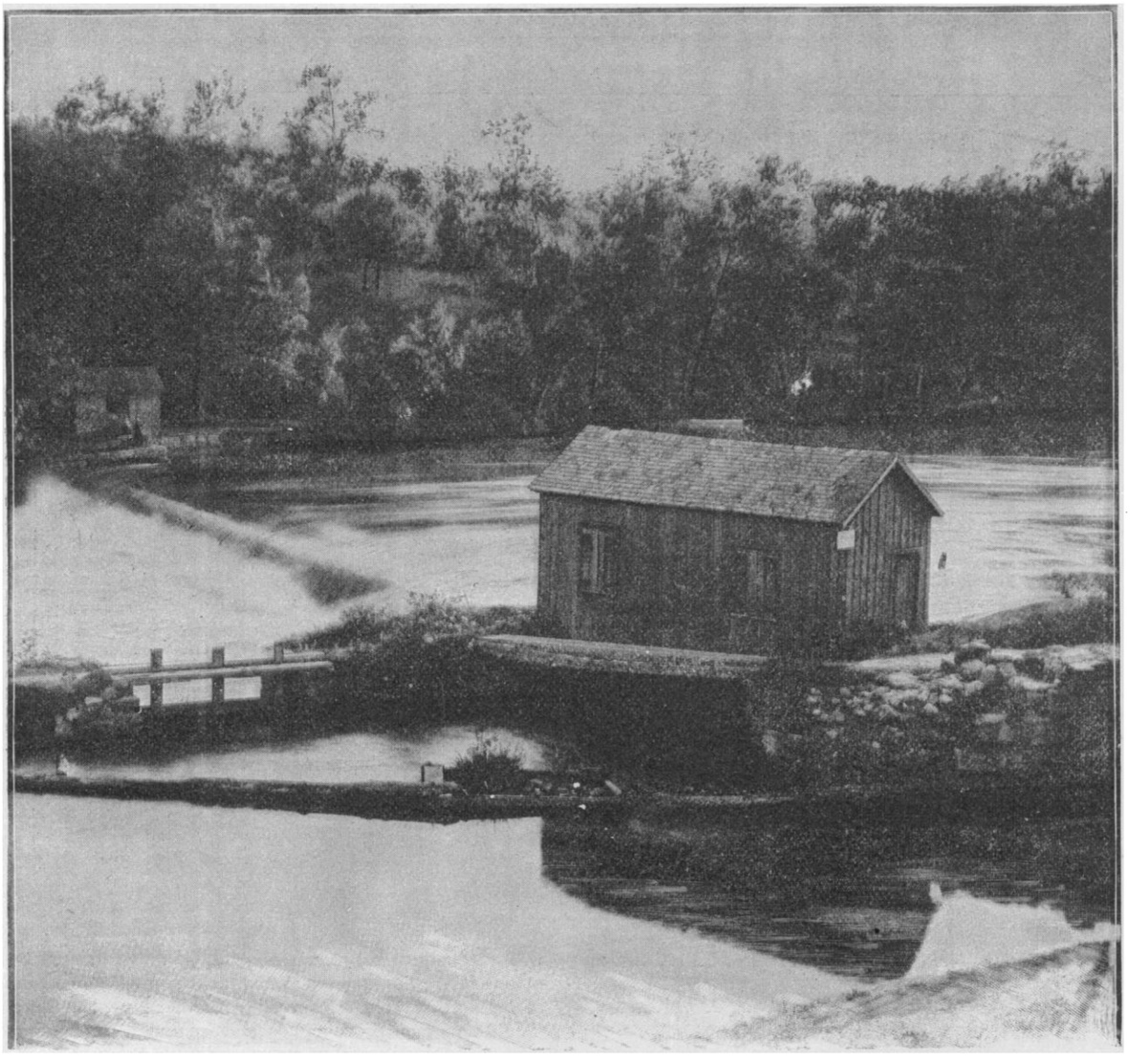
THE introduction of prunes into France is attributed to the Crusaders, says our consul at Bordeaux; and, if tradition is exact, this valuable fruit was first cultivated in the south-west of France by the inmates of a convent near Clairac. In travelling from Avignon to Fumel, through the valley of the Lot, fertile plains are seen covered with plum-trees, which furnish the famous *prunes d'Ente* and *Robe-Sergent*, these being exported to the remotest corner of the commercial world. The plum-tree does not confine itself to this particular district of France, but it is profitably cultivated in the valley of the Loire, the departments of the Garonne, Dordogne, Tarn, and Aveyron. The well-known brand called Tours' prunes comes from the orchards of the Loire. Lorraine produces a variety called Quetsche, one of the best for ordinary preserves.

The prune-tree thrives best in clayey, calcareous soil, and does not exact for its roots a loam of profound depth. Land adapted to the culture of the vine is also partial to this tree. In many localities these two valuable products are cultivated together, as the broad leaf of the vine is especially useful in protecting the roots of the tree from the intense heat of summer. When the prune is ripe, it is covered with a sort of glaucous powder called "flower," which greatly adds to its value as a table-fruit. The fruit is usually gathered after the heat of the day has dissipated the humidity of the night, and, when possible, straw is spread beneath the trees to prevent the fruit coming in contact with the earth. Only such fruit as readily falls when the tree is slightly shaken is gathered. As soon as harvested, the fruit is taken to a building, where it remains for a few days to complete maturity.

Prunes are subjected to not less than three, and frequently to four, distinct cookings before being pronounced ready for market.

The first two preliminary cookings have for their object the evaporation of water contained in the fruit, and preparation for the final cooking, which dries the fruit and imparts a certain brilliancy much sought after by buyers. In several districts of France, most primitive means are practised in curing the fruit for market. In Provence freshly gathered fruit is plunged into pots of boiling water, where it remains until the water again arrives at boiling-point. It is then removed from the boilers, placed in baskets, and gently shaken until cool, when it is placed on long trays and exposed to the heat of the sun to complete desiccation. At Digne the prunes are not gathered until completely matured. Women peel the fruit and cumbersome, and very primitive in their construction, only consisting of a frame to which is fastened a wicker-like bottom fashioned from rushes or willow twigs. They hold from twelve to eighteen pounds of green fruit, representing about four to six pounds of prunes. Care is taken, in preparing the oven for the first cooking, that the degrees of heat shall not exceed 50° C.; and in the second, 70°.

After each cooking, which occupies about six hours, the fruit is removed from the oven and exposed to the air. When the prunes are cold, they are carefully turned by women specially charged with this duty. They avoid disturbing the fruit while it is warm, as the



THE ROCKAWAY RIVER AT THE BOONTON FALLS, SHOWING INTAKE OF THE MORRIS CANAL (ELEVATION ABOVE TIDE-WATER ABOUT 560 FEET).

with their nails to avoid injury to the soft pulp. The fruit is strung upon small twigs, and in such fashion as not to touch. These sticks of prunes are stuck into straw frames, which are suspended in the sun until the prunes easily detach themselves from the stick. The pit is then removed, the fruit placed upon trays exposed to the sun, and, when thoroughly desiccated, packed for market. In the departments of Indre-et-Loire and Lot-et-Garonne, immense ovens, specially constructed for prune-cooking, are used.

Most prunes are subjected to a preliminary washing to free them from dust or sand. After washing, the fruit is exposed to the sun or air on beds of straw, or on the trays on which it is cooked, to rid it of all humidity. When dry, it is spread in a single layer on the tray, and at once submitted to the oven. The trays used are made during the winter months by peasants. They are clumsy

touch renders it glutinous and prevents the fruit from congealing. The third cooking is performed at a temperature of 80° to 90°, and occasionally at 100°. After the third cooking, the prunes are sorted, and such as are found imperfectly cooked are again submitted to the oven. The degree of perfection in cooking is obtained when the fruit presents a dark purple color, solid and brilliant surface, malleable and elastic to the touch, and when the kernel is well done and intact in the shell. When these conditions are not obtained, the kernel ferments, and alters the entire prune, which very soon becomes mouldy and worthless.

Prunes are divided into nine categories, and are classified as follows: No. 1 represents 90 to 92 to the pound; No. 2, 80 to 82; No. 3, 70 to 72; No. 4, 60 to 62; No. 5, 55 to 56; No. 6, 44 to 45; No. 7, 40 to 41; No. 8, 34 to 35; and No. 9, 30 to 31. When ready

for exportation, the fruit is pressed flat between two cylinders covered with India-rubber, and then packed into cases by a special machine, called a "packer." Many dealers still perform this operation in the primitive manner of foot-pressure. Bordeaux is the principal centre of their industry, which is yearly increasing.

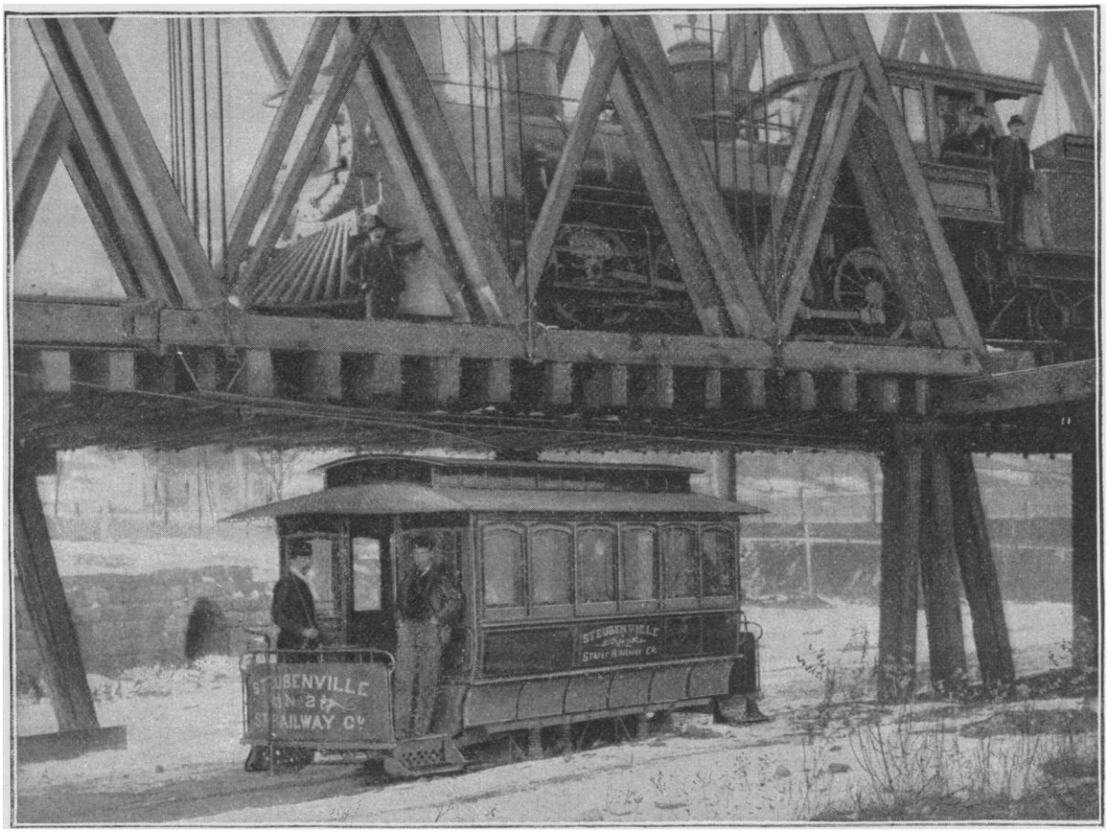
Besides the large amount of prunes exported to European countries by rail, there are, says Consul Roosevelt, about one hundred vessels annually leaving the port of Bordeaux loaded with this produce. In the beginning of the prune-industry, many devices were employed for their proper conservation. The first ovens were very primitive, and the work of preparing the fruit for market laborious. At present there are many different kinds of ovens in use, possessing more or less distinct features, but almost the same in general principles. The most generally used are the Bournel and the Marletean ovens. The only ovens in use are of French manufacture.

We also give a view taken from a photo of the Asheville, N.C., Electric Railway.

Asheville is a flourishing mountain town, noted throughout this country as a health-resort; and it is characteristic of such a town and its enterprise that it now has an electric railway, first-class in all particulars, which gives the people perfect and comfortable means of transit to the depots and hotels, and replaces the old springless hacks and primitive omnibuses.

The picture shown is from a photo taken shortly after the opening of the road, and represents three of the Sprague electric cars turning a corner into the main street of Asheville, N.C.; and it is an interesting feature to notice that it is difficult to discern the overhead system at all, on account of the smallness of the wires.

Besides an equipment of passenger street-cars, this electric railway also possesses several freight-cars, also operated by electric motors of the Sprague type; and, as this road connects the depot of the North Carolina Railroad with the city of Asheville, these freight-cars have proved a convenience and a source of income.



ELECTRIC RAILWAY AT STEUBENVILLE, O., CAR PASSING UNDER RAILROAD-BRIDGE.

SOME NEW ELECTRIC RAILWAYS.

THE accompanying engraving is from a photograph representing one of the Sprague electric cars in operation at Steubenville, O., passing under a railroad-bridge on the route of the road. The picture gives a very good idea of the wide range of movement of the trolley-arm, which can reach from 12 to 14 feet above the car, to less than 1 foot, when the location of overhead wire demands such a wide change. The kind of trolley-pole used upon this road is light and unobtrusive, consisting of a light, hollow iron rod carried on top of the car, and supported from the car by a stout steel spring, which allows it to move in every direction necessary.

The equipment of this road includes the regular Sprague system of overhead wiring, with main and working conductor running parallel, connected at intervals of every 100 to 200 feet. The road has been a success from the start, and has been visited by many street-railway managers from Ohio, Indiana, Kentucky, and western Pennsylvania.

THE SUBMARINE BOAT "GYMNOTE."

WE have already given some details of the "Gymnote;" but the following, taken from *Industries*, gives some additional information as to her construction. After the first trials of the "Gymnote," it was found that various details required modification, but on the whole the trials were satisfactory; and, now that the improvements which the first trials indicated to be necessary have been made, the French Government have accepted the "Gymnote" as the standard type of submarine vessel for offensive purposes. The hull is spindle-shaped, 6 feet in diameter by 56 feet long, provided with horizontal and vertical rudders, and with a cylindrical conning-tower of somewhat novel design. The conning-tower consists of a fixed tube, within which slides a second tube, carrying at its upper end a mirror inclined at an angle of forty-five de-

grees. When the inner tube is pushed right out, and the boat is floating near the surface, only the top of the telescope tube need be above the water; and the captain, standing within the boat, by glancing upward, can see in the mirror what is going on in front of him, or, for the matter of that, all around him, if the inner tube be revolved. By means of this ingenious application of a telescopic conning-tower with a mirror, the size of that part of the vessel which must project above the water-level to permit of an observation being taken, has been much reduced, as compared with the old plan of making the conning-tower large enough for the captain's head and shoulders to enter. In the stem of the vessel is fixed the torpedo-launching tube, and in the stern the electric motor by which the propeller is driven. There are various water-ballast tanks by which the vessel is trimmed, and access to the interior is afforded by a man-hole a little forward of the conning-tower. The power for working this vessel is derived from a battery of 564 Commelin & Demazures alkaline accumulators, weighing, in working order, close upon 10 tons. A compound switch is provided by means of which the battery can be differently grouped; the combinations being 12 cells parallel and 47 in series for very slow speed, 6 in parallel and 94 in series for slow speed, 4 parallel and 141 in series for ordinary travelling speed, and 2 parallel and 282 in series for fast speed. The weight of the battery per horse-power is 83 pounds. The electric motor works the propeller direct without the intervention of any speed-reducing gear, and has been specially designed for this purpose by Capt. Krebs. It is a sixteen-pole disk machine, weighing 2 tons, and developing 52 horse-power at a speed of only 280 revolutions a minute. The armature is 40 inches in diameter, and the winding is such as to require only four brushes. The resistance of the machine is .16 of an ohm. At full speed, the motor is sufficiently powerful to propel the boat at a speed of 9 to 10 knots per hour; the capacity of the battery being said to correspond, under this condition, to about four and a half hours of work, which would take the boat over a total distance of 40 to 45 knots. At a speed of 6 knots an hour, the total distance that the boat could travel with one charge would be about 120 knots.

While the "Gymnote" is a boat mainly intended for the discharge of torpedoes against the enemy's ships, a second and much smaller submarine boat is now being built, the mission of which will be to render the enemy's submarine mines harmless by cutting their cables. This boat is also spindle-shaped, but only 15 feet long by 5 feet 3 inches in diameter, and will have a crew of two men only, whereas the crew of the "Gymnote" is from six to eight men. As the cubic capacity of this boat is comparatively small, compressed oxygen is to be carried as part of the equipment. The boat is to be provided with powerful scissors, working from inside, by means of which it is intended to cut the electric cables of the submarine mines. The screw is mounted on a swivel-shaft to facilitate the manœuvring, and is worked by an electric motor driven by a battery of Schanscheiff primary cells. The boat is lighted by five small glow-lamps; and a small arc-lamp with a projector is also provided, the beams of light from which can be thrown forward through glass lenses fixed in the hull, so as to illuminate the water for a certain distance ahead, and thus make the work possible for which this boat is especially intended.

If this country is going to rely to a great extent on torpedoes as a coast defence, the recent improvements in submarine boats cannot but be of great interest to Americans. Congress recently appropriated a considerable sum for the construction of such a vessel, and, although nothing definite is known about the plans that will be adopted, yet it is understood that electricity will not be the motive power.

VIEW OF ELECTRIC ROAD AT ASHEVILLE, N.C.

NATURAL GAS IN OHIO IN 1888.

A LATE number of the *American Manufacturer* has a careful review of the natural-gas situation in Ohio, by Professor Edward Orton, the State geologist, who says in effect that no important discoveries have been made in Ohio during the year 1888, though a

great deal of drilling has been going forward, and the productive districts remain as at the end of 1887, four in number; viz., the Berea grit, the Ohio shale, the Clinton limestone, and the Trenton limestone. The last-named stratum, which is both a gas and oil bearing rock in northern Ohio and central Indiana, is, excepting possibly the Bradford sand, the most important single source of petroleum and gas on this continent. The oil is still ranked as inferior, on account of the present difficulty of refining it; but there is no drawback to the gas, as is apparent from the following analyses, made for the United States Geological Survey: —

	Findlay.	Fostoria.	St. Mary's.
Hydrogen	1.64	1.89	1.74
Marsh-gas	93.35	92.84	93.85
Olefiant gas	.35	.20	.20
Carbonic oxide	.41	.55	.44
Carbonic acid	.25	.20	.23
Oxygen	.39	.35	.35
Nitrogen	3.41	3.82	2.98
Sulphuretted hydrogen	.20	.15	.21
Total	100.00	100.00	100.00

The small fraction, one-fifth of one per cent, of sulphuretted hydrogen is held to be decidedly advantageous, as it affords a certain means of detecting leaks.

No place within the natural-gas belt has derived greater advantages from this fuel-supply than Findlay, where in November, 1884, it was first found that the Trenton limestone, at some places at least, contained stores of high-pressure gas. Since January, 1886, the population of the town has increased from 6,000 to 30,000. Although there are rolling-mills, chain-works, machine and edge-tool shops, etc., the principal industry is glass, 155 pots being used by the ten firms engaged in making window-glass, fine flint ware, and bottles.

This growth has been built up in Findlay, as in other towns, by giving free, or nearly free, gas to manufacturers, — a gift which in some instances has been supplemented by land and contributions to capital, either from the town or parties interested in real estate. Under these circumstances, the question of the continuance of the supply is a vital one. Professor Orton has contended that the supply is a stored one, and notwithstanding the reasonableness of the theory, in view of the exhaustion of all deposits of liquid hydrocarbons, the gas has been used most profusely for the rough work of founderies, rolling-mills, brick and tile works, lime-burning, and the like, until, a short time since, Findlay found itself short of gas. A new well was drilled in, and, on being shot, responded with a pressure in the open casing of from 38 to 40 pounds, equivalent to a yield of about 30,000,000 cubic feet per day. The famous Karg well, which has been the main reliance of the town for the past two years, was estimated to discharge 12,000,000 cubic feet.

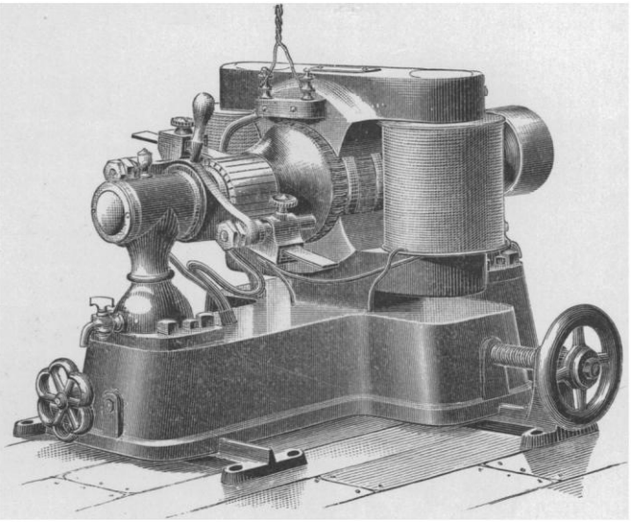
This shortage of gas has led to an investigation, from which the professor concludes that none of the large wells in the field have flowed three years, practically unrestrained, without giving unmistakable signs of nearing their limit. In some cases oil invades them; in others, salt water. The smaller wells appear in some instances to have a longer lease of life than the great wells. In some of the town wells the original rock pressure has been reduced by about three-eighths, but in others it is claimed it is fully maintained, only more time is required for gathering. The area exhausted by a vigorous well is not yet determined, but it is thought that the central portion of Findlay is partially drained of its original supply. As the city has pledged itself to furnish many million feet of gas each day, great energy and sagacity will be required to maintain in full vigor the splendid industries now established, and insure the continued prosperity of the town.

What is predicted of the Ohio Trenton limestone gas-field may probably be asserted as to the 2,000 square miles of the field in Indiana, though, if wells yielding 30,000,000 cubic feet of gas per day, equivalent to nearly 1,000 tons of coal, are to be found whenever a shortage occurs, there may be a longer lease of the industrial life of that region than a cursory reading of Professor Orton's article might lead one to infer.

THE DENISON MOTOR AND DYNAMO.

THE accompanying illustration shows the form of dynamo and motor now manufactured by Mr. J. F. Denison of New Haven, Conn. These machines do not differ in their construction much from that which experience has shown to be desirable, but the motors have some points worthy of special consideration.

An arrangement known as the Denison interlocking starting attachment is contained in the base of the machine, and is said to prevent any mistake in operating the motors. This attachment is



THE DENISON MOTOR AND DYNAMO.

so arranged that the current cannot be thrown on unless the resistance in the rheostat in the base is in the proper position. This is manipulated by a hand-wheel. In case of accidental breaking of the circuit, an automatic lock makes it impossible to turn the current on until the resistance is again in normal condition. The absence of attachments external to the machine, which are usually placed on the wall, the machine being entirely self-contained, does away with the expense of sending out special attendants to set it up. Further, as there are but two binding-posts, it is impossible to make a mistake in wiring.

HEALTH MATTERS.

Analysis of Foods.

THE commissioner of internal revenue of the United States has published the regulations concerning the analysis of foods and drugs in the District of Columbia. These regulations are based on the Act of Congress passed in 1888, entitled "An Act to prevent the Manufacture or Sale of Adulterated Food or Drugs in the District of Columbia." Section 12 of this Act provides that any health-officer, inspector of nuisances, or any food-inspector, may procure any sample of food or drug, and, if he suspects the same to have been sold to him contrary to any provision of the Act, he shall submit it to the commissioner of internal revenue to be analyzed. An offence shall be deemed to be committed in the case of drugs, if it differs from the standard of strength, quality, or purity laid down in the pharmacopœia, or falls below the professed standard under which it is sold. In the case of foods, the regulation gives a standard for butter, cheese, cocoa, chocolate, coffee, honey, lard, malt liquors, milk, mustard, olive-oil, oysters, pepper, tea, vinegar, wheaten flour, bread, and wine.

A large number of coloring-matters are prohibited for use in foods. Among these are aniline, gamboge, fuchsine, naphthol yel-

low, and others. Salicylic acid and its salts are prohibited, as are also boracic acid and borax, glycerine, and alum. A list of harmless coloring-matters is given. The pamphlet also contains a list of periodicals, official reports, and general and monograph volumes of the greatest importance in connection with the detection of adulteration of food and drugs. This bibliography is exceedingly valuable, and, we should judge, very complete.

THE SURGEON-GENERAL AND THE NATIONAL BOARD OF HEALTH. — The "Annual Report of the Supervising Surgeon-General of the Marine Hospital Service of the United States for the Fiscal Year 1888," has just been published. It contains the customary statistics of this branch of the national service, and, in addition, a considerable amount of interesting matter in reference to the recent epidemic of yellow-fever in Florida, with photographic illustrations of the camps of refuge, and a map of Jacksonville showing the streets and sewers. It is much to be regretted that the supervising surgeon-general should, in an official report, have attacked the National Board of Health, and the excellent work which it did during the days when it had the power and the means. He charges Dr. Bowditch of Boston with "special pleading for a pet object," when, in September last, he expressed in a public letter the wish that a new birth might be granted to the national board with greater powers. The supervising surgeon-general speaks of this letter as being "ingeniously constructed," and further says that unfortunately the facts do not bear out the statements therein contained. If men of the standing and reputation of Dr. Bowditch can be thus attacked in governmental reports, we shall wish that some censorship may be established to which these reports shall be submitted before they are permitted to go forth with the official sanction.

TEMPERANCE INSTRUCTION IN PUBLIC SCHOOLS. — The report of the Department of Scientific Temperance Instruction in Public Schools for the year 1888 shows that twelve million children in this country are now under compulsory temperance education laws; that is to say, that the law has provided the education in favor of total abstinence that results from learning the nature and effects of alcoholic drinks and narcotics. This report further shows that there is no New England State without such a law; New Jersey is the only Middle State that has not enacted such a law; ten Southern and two Western States are still unprovided in that regard. The Act of Congress of 1886 brought all the Territories under the law. Those interested in this subject will find reports from the different sections of the country of the work done, and the difficulties to be met and overcome in States in which as yet compulsory laws have not been enacted.

DIPHTHERIA AND SANITATION. — If the reports which the newspapers publish in reference to the sanitary condition of Gallitzin, Penn., are true, it is not a matter of surprise that diphtheria, once introduced, should prevail in epidemic form. In a population of only two thousand people, one hundred deaths from this disease are said to have occurred since November. The disease is attributed to the disregard of the common rules of sanitation. The town has no water-supply. The outhouses and wells stand close together, and, since the McCoy mines have been opened, over half the wells in the town have gone dry. The inhabitants have used water from the few remaining wells that have become impure. Fortunately there is an excellent State board of health in Pennsylvania, which will at once take the matter in hand.

ETHNOLOGY.

The Blackfoot Sun-Dance.

MUCH has been said regarding the barbarous dances of the Blackfeet and their neighbors, but the majority of reports have been made on hearsay. Therefore an authentic description of the ceremonies by an eye-witness, who is, moreover, thoroughly conversant with the native language, must be highly welcome to students of primitive man. The Rev. Dr. John McLean has presented such a description to the Canadian Institute of Toronto. It is one of the important results of the establishment by the British Association, of a committee for the study of the Indians of the Canadian North-west, that missionaries begin to improve their opportunities of observing native customs, and of making available their studies of native languages.

The sun-dance is celebrated every summer. Last summer, when Dr. McLean visited the Blood Indian camp, he found the sun-lodge erected. There were by actual count one hundred and ninety-eight lodges, comprising about two thousand souls. An old man was riding through the camp, calling upon the people to attend the ceremonies. In a lodge near at hand, a medicine-man was decorating the persons who were to undergo the rite of torture. In arranging their head-dress, before putting it on, he passed his hand around it four times, praying. In the sun-lodge the sacred fire was burning, and this was used by the people for lighting their pipes. No child or woman was allowed to supply the fuel; but young men who had performed some valorous deed, especially the stealing of horses from a hostile tribe, felt it to be an honor to attend to this duty; and none but the brave are qualified for this work. On the sacred pole were placed, in the form of a cross, two bundles of small brushwood taken from the birch-tree. The pole was decorated with sacrifices to the sun of clothing and various kinds of Indian goods. The cross evidently refers to the four winds, from its four points, as does the number 4, which is regarded as the sacred number. In the bower made of light brushwood sat a woman who gave the festival that year, her husband, and a medicine-man. These persons were fasting and praying; and, during the full term of the continuance of the ceremonies, very little food was partaken of. In the mornings they were allowed a short smoke and a little water; and in the evenings a few of their friends brought a small quantity of food hidden under their blankets, and, without exposing it to view, it was eaten in silence. The medicine-man had a crown of leaves upon his head. His body was painted, and without any clothing, save a long strip around his loins. At short intervals he arose and danced, keeping time to the motions of his body with a small bone whistle, which he blew upon incessantly, producing a series of monotonous sounds. In the evening the woman prayed to the sun for good health for the people, protection in danger, good crops, and a bountiful harvest of wild fruits. The virgins came in the evening, and prayed for a long time for blessings from the sun. During the day the ceremonies consisted of dramatic representations of heroic adventures by single individuals, and contests with the Crow and Sioux Indians by war-parties. One chief borrowed several guns from his friends, and a large number of Indian war-implements and native trinkets. Stepping forward that all the people might see him, amid profound silence, he addressed the assemblage. Holding a gun aloft, he told how, in a contest with an enemy, he had slain him and taken his gun. The band of musicians beat on their tomtoms in token of applause. Each article that he had represented his various victories, and each had its separate story, which was narrated at first, and the same routine gone through. When he had finished, the whole assemblage joined the musicians in applauding the speaker. Many warriors during the day related their brave deeds in the same manner.

Sham-fights were engaged in, which were representations of actual battles. Five or six warriors appeared as Crow Indians, and the same or a less number were the Blood Indian warriors. A single horse represented that they had been on horseback, and this was decked in its war-paint. One of the men, the hero of the battle, acted as instructor of the ceremonies to the others. Four times they entered the lodge, and then the fight began. They fired their guns over the heads of the people; the Crow Indians fell one by one; and when they had been scalped, amid the laughter and applause of the audience, the scene was at an end. Berries cooked in fat were brought in by the women in pails and pots; and for a short time eating, smoking, and conversation were the duties of the hour. Occasionally some old lady would call out the name of a young man, and declare his noble qualities before the people; and another would urge the young men to emulate the heroic deeds of their fathers, and go to war.

Presents of bracelets, finger-rings, and ear-rings were made to some of the women. The chief warrior carried in his hand the sacred pipe, which he first held aloft with the stem toward the sun, that he might have the first-fruits of every thing; and still holding it,

stem toward the chiefs, each was allowed to take a smoke. The pipe was beautifully ornamented, and was used only at the sun-dance. Some of these pipes are of great value, the one seen costing fifteen of the best horses in the tribe, and these were used for hunting the buffalo. The women have one important ceremony to perform; namely, the preparation of the tongues. In former years, when buffalo were in abundance, as many as two thousand buffalo-tongues were used at a single sun-dance: now the Indians have to be contented with two hundred tongues of domestic cattle. These are slightly boiled and dried, cut in slices very carefully, taken in sacks to the sun-lodge, and guarded by two young men. This rite partakes of the nature of a sacrament. None but virtuous women are allowed to go up and take a piece of tongue. After the persons devoted to the sun have partaken of the meal, the rest of the tongues are distributed among the people as a religious ceremony.

At this time a young Indian went to an old medicine-woman and presented his sacrifice to the sun. During the year he had gone on a horse-stealing expedition, and, as is customary on such occasions, had prayed to the sun for protection and success, offering himself to his god if his prayers were answered. He had been successful, and he now presented himself as a sacrifice. The old woman took his hand, held it toward the sun, and prayed; then, laying a finger on a block of wood, she severed it with one blow of a knife. She held the portion of the finger cut off toward the sun, and dedicated that to him as the young man's sacrifice.

One of the principal features of the sun-dance is the self-torture of those who are admitted as warriors. Dr. McLean witnessed one of these ceremonies. Two young men, having their whole bodies painted, wearing the loin-cloth only, and with wreaths of leaves around their heads, ankles, and wrists, stepped into the centre of the lodge. A blanket and a pillow were laid on the ground, and one of the young men stretched himself upon them. As he lay, an old man came forward and stood over him, and then in an earnest speech told the people of the brave deeds and noble heart of the young man. In the enumeration of his virtues and noble deeds, after each separate statement the musicians beat applause. When the aged orator ceased, the young man arose, placed his hands upon the old man's shoulders, and drew them downward, as a sign of gratitude for the favorable things said about him. He lay down, and four men held him, while a fifth made the incisions in his breast and back. Two places were marked in each breast, denoting the position and width of each incision. This being done, the wooden skewers being in readiness, a double-edged knife was held in the hand, the point touching the flesh, a small piece of wood was placed on the under side to receive the point of the knife when it had gone through, and the flesh was drawn out the desired length for the knife to pierce. A quick pressure, and the incision was made, the piece of wood was removed, and the skewer inserted from the under side as the knife was being taken out. When the skewer was properly inserted, it was beaten down with the palm of the hand of the operator, that it might remain firmly in its place. This being done to each breast, with a single skewer for each, strong enough to tear away the flesh, and long enough to hold the lariats fastened to the top of the sacred pole, a double incision was made on the back of the left shoulder, to the skewer of which was fastened a drum. The work being pronounced good by the persons engaged in the operation, the young man arose, and one of the operators fastened the lariats, giving them two or three jerks to bring them into position.

The young man went up to the sacred pole, and, while his countenance was exceedingly pale, and his frame trembling with emotion, threw his arms around it, and prayed earnestly for strength to pass successfully through the trying ordeal. His prayer ended, he moved backward until the flesh was fully extended; and, placing a small bone whistle in his mouth, be blew continuously upon it a series of short, sharp sounds, while he threw himself backward, and danced until the flesh gave way and he fell. Previous to his tearing himself free from the lariats, he seized the drum with both hands, and with a sudden pull tore the flesh on his back, dashing the drum to the ground amid the applause of the people. As he lay on the ground, the operators examined his wounds, cut off the flesh that was hanging loosely, and the ceremony was at an end. In former years the head of a buffalo was fastened by a rope to the back of a person undergoing the feat of self-immolation, but now a drum is used for that purpose.

From two to five persons undergo this torture every sun-dance. Its object is military and religious. It admits the young man into the noble band of warriors, whereby he gains the esteem of his fellows, and opens up the path to fortune and fame. But it is chiefly a religious rite. In time of sickness or danger, or in starting upon some dangerous expedition, the young man prays to the sun for help, and promises to give himself to the sun if his prayers are answered. Upon his return, when the annual sun-dance is held, he fulfils his vow, gives himself to his god, and thus performs a twofold duty. Of course, the applause of the people and the exhibition of courage are important factors in this rite, but its chief feature is a religious one. Instead of being a time of feasting and pleasure, the sun-dance is a military and religious festival, in connection with which there are occasions for joy, and the feast enhances the pleasure.

During the feast the entire assemblage will burst forth in songs of thanksgiving, and again a famous warrior will sing aloud the praises of a young man or some brave kinsman who merits the applause of the tribe. This is a kind of chant, in which the name and noble deeds are spoken of.

A SURVIVAL OF CORPORAL PENANCE. — The state of mind from which the infliction of self-torture arises is not confined to primitive people, but has manifested itself in all great religions of the world. In the middle ages the Order of the Flagellants was devoted exclusively to this purpose. A survival of this once powerful organization offers an interesting comparison to the practices of the Blackfeet, just described. This was observed to exist by Mr. O. H. Howarth in the village of Fenaês d'Ajuda on the Azores, and has been described by him in a recent number of the *Journal of the Anthropological Institute*. The Order of the Ferceiros in that place now consists of a body of from fifteen to eighteen lay inhabitants of the parish, who are admitted to it by election every seven years; the order being held in such reverence, and the efficacy of the penance so profoundly believed in, that vacancies are much sought after. The ceremony takes place annually in connection with the procession of N. S. dos Passos on the third Sunday in Lent. The costume of the Flagellants is a white linen tunic, with a large oval opening in the back for the purpose of flagellation; and the head of the performer is entirely concealed with a wrapper of white linen, so that his identity may be unknown to the general spectators. Mass is conducted by the priest, and the flagellation commences when the church is darkened in the course of the Lenten ritual, the order kneeling in two rows at each side of the chancel. It is continued throughout the procession which follows. The principal streets of the village are traversed, and the self-punishment is inflicted with special violence during pauses at the street-corners, when the members of the band seem to vie with one another in the severity of their discipline. The procession returns to the church; the flagellants resuming their former position, and continuing to scourge themselves with increasing vigor until the conclusion of the ceremony. The torture is carried to such extremities that the side walls, railings, and confessionals in the chancel are smeared and spotted with blood to a height of four or five feet. The type of the scourge and flagellum are such that the author concludes the institution to be kept up by unbroken tradition from the middle ages, the implements being of the same description as those used six centuries ago by the Flagellants.

ELECTRICAL NEWS.

SMALL ENGINES FOR ELECTRIC LIGHTING. — The Society of Arts in England having offered a gold medal for the best small engine to be used for electric lighting, some tests have just been published giving the results of the trial. There were four competitors, — three gas-engines, and a high-speed high-pressure steam-engine. As the machines are especially useful for isolated lighting plants, the results give some valuable data as to the cost of lighting by electricity as compared with gas. One of the three gas-engines,

the Otto, is well known in this country. A mixture of gas and air is admitted into the cylinder and ignited, the explosion giving the motive power. The arrangement is such that the engine receives one impulse in every two revolutions; so, in order to get a steady motion, an extremely heavy fly-wheel, or a countershaft carrying a fly-wheel, is necessary. Another of the gas-engines, the Atkinson, is of rather remarkable design. There are four strokes of the piston to one revolution of the fly-wheel, and these strokes are of varying length. The stroke which takes the charge into the cylinder is 6.3 inches; the next stroke compresses the charge, and is 5 inches in length, the charge being thus compressed into a space of 1.3 inches. The compression being effected, ignition takes place, giving the working stroke, which is 11.13 inches in length. This is followed by the exhaust stroke, which sweeps the products of combustion out, and is 12.4 inches in length. The cylinder is 9.5 inches in diameter. The third of the gas-engines, the Griffin, differs from the other two in several particulars. An impulse is given to the crank-shaft for every revolution and a half. The tests were made by Professor A. C. W. Kennedy, Dr. John Hopkinson, and Mr. Beauchamp Tower. Taking first the Atkinson engine, they found that the gas consumed per indicated horse-power was 18.8 cubic feet, and per brake horse-power 22.1 cubic feet per hour. The gas used for ignition was 4.5 cubic feet per hour, making a total per brake horse-power of 22.6 cubic feet per hour. The engine ran smoothly and with regularity. The mechanical efficiency of the engine was 85 per cent, and 25.5 per cent of the whole of the heat generated was converted into work. The Otto engine used 27.4 cubic feet of gas per hour for an available horse-power. The Griffin engine used 28 feet per hour for an available horse-power. These figures show, that, as far as the cost of gas is concerned, it is more economical to use it to drive an engine, and use the power developed for electric lighting, than to burn it directly. For instance: if we take 25 cubic feet of gas per hour as the average amount consumed per horse-power by a gas-engine, then we have, by burning direct, 5 16-candle-power gaslights; with gas-engine and dynamo, 12 16-candle-power electric lights. There are at present, however, so many additional expenses incident to an isolated electric plant, — interest, depreciation, breakage, attendance, etc., — that it is cheaper to use the gas directly. At the same time, the figures given suggest possibilities. The fourth engine tested was a Davy-Paxman steam-engine of about twenty horse-power. This gave some remarkable results. It is a compound engine, the cylinders being 5.24 and 8.98 inches in diameter, and the stroke 14 inches, the pressure used being 190 pounds. The result of one of the trials was an available horse-power for 2.08 pounds of coal per hour, — a remarkable result, considering the size of the engine. These results show, that, as far as cost of fuel alone is considered, a horse-power hour from a gas-engine, with gas at $1.50 per thousand feet, would cost 3.75 cents; and from a Davy-Paxman engine, with coal at $4 per ton, .8 of a cent.

ACCUMULATORS. — Judge Coxe has just rendered a decision in the United States Circuit Court for the southern district of New York, in which the Faure patent for improvements in secondary batteries or accumulators is held to cover any secondary battery in which an electrode is used having the so-called active material applied in the form of a paint, paste, or cement. The suit is entitled "The Electrical Accumulator Company *vs.* Julien Electric Company." The field for accumulators is very large, as shown by the fact that there are to-day no less than eight or ten companies engaged in that business. Among them are the Electrical Accumulator Company, owning the Faure patents, and the Julien, Gibson, Woodward, Pumpelly, and Macræon Companies, all of whose batteries, the Accumulator Company claims, are tributary to the Faure invention. In anticipation of a favorable decision, the Electrical Accumulator Company has already built a street-car to be propelled by means of batteries, and now has it on exhibition on Elkins & Widener's Philadelphia Traction Road in West Philadelphia. Its initial trip last Friday was a success, the car moving up a long five-per-cent grade at the rate of seven miles an hour. Brill & Co., West Philadelphia, are making six other cars to be completed in April and May; and the Electrical Accumulator Company is now prepared to occupy extensively the electric street-car field.

NOTES AND NEWS.

DR. R. W. SHUFELDT has moved from Fort Wingate, N.Mex., to Washington, D.C., where he will continue in his scientific pursuits at the Smithsonian Institution.

— The wind-pressure on the Forth bridge, or rather the effective area of a bridge exposed to a wind-pressure striking the work at different angles, was practically demonstrated by Mr. B. Baker, as described in a late lecture before the Society of Arts, as follows: a model of the bridge was made, and towed in water at different angles to the stream; the area of a flat board normal to the current was then determined, which exerted the same drag as the model; this area was then taken as the effective area of the bridge for the particular angle at which it was towed.

— M. Alfred Binet of Paris, France, will contribute to *The Open Court* (Chicago) of March 21 a paper on "Sensation and the Outer World." The article is part of an unpublished essay upon "External Perception," crowned by the Académie des Sciences Morales et Politiques. In the same number Professor Edward D. Cope of Philadelphia will present some considerations upon ethical evolution, including a review of the extent and significance of the utilitarian doctrine of morals. *The Open Court* of March 28 will contain an article by the German Sanscrit scholar, Professor H. Oldenberg, on the "Discovery of the Veda." The disclosures that this epoch-making event have led to, form the most interesting chapter in all philological science.

— The composition and evaporative power of Kansas coals have been investigated by Professor E. H. S. Bailey and Professor L. I. Blake, of the State University. The coal-measures that underlie the eastern part of the State of Kansas are being developed at the present time to a greater extent than ever before. With the increased population of the State, the introduction of important manufactories, and the extension of so many lines of railway, there is naturally a greater demand for fuel, and a greater interest in its economic supply. In the last "Report of the State Mine Inspector" (1887), there are mentioned about a hundred shafts, in the different regions, where mining is actively carried on; besides this, there are innumerable places where coal is mined or stripped in a small way to supply the local trade. The coal-beds seem to be divided into several groups, the lowest being in the extreme south-eastern part of the State. The coals depreciate in their steam-producing powers from the south-eastern part of the State toward the north and west. Professor Bailey finds they depreciate in the amounts of fixed carbon in a similar order.

—The Johns Hopkins Hospital will be opened to the inspection of the public, before the reception of patients, during the week beginning May 6, 1889. On Tuesday, May 7, at 11 o'clock in the morning, there will be appropriate addresses in the main administration building. Invitations to be present will be sent to the authorities of the city and State, to those who have rendered special services in promoting the plans of the hospital. to professors of medicine and surgery, to the chief managers of other hospitals, and to the representatives of the press. On Wednesday, May 8, between the hours of 12 and 6 o'clock, the buildings will be open to the medical profession of Baltimore, Washington, and the State of Maryland, to medical students, to the managers of the benevolent institutions of Baltimore, to the ministers of all religious denominations, and to other persons whose pursuits have led them to take a special interest in hospital-work. Cards of admission will be distributed in advance. On Thursday, May 9, and Friday, May 10, between the hours of 12 and 6 o'clock, the public generally will be invited to visit the hospital. Cards of admission may be obtained, on the days named, at the entrance-gate of the hospital, Broadway. On Saturday, May 11, the faculties of the various institutions in Baltimore, the teachers of public and private schools of every kind, the students of the Johns Hopkins University, the Baltimore City College, the State Normal School, the Woman's College of Baltimore, and the Eastern and Western Female High Schools, will be admitted between the hours of 10 and 6 o'clock upon the presentation of tickets, which will be distributed in advance. The dispensary will be opened for the treatment of out-door patients, Monday, May 13, at 10 o'clock. The hospital will be opened soon afterwards for the treatment of patients.

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CONTENTS:

DR. WILLIS G. TUCKER, analyst of drugs, has made his eighth annual report to the State Board of Health of New York. He has collected and analyzed 326 samples of drugs, and pharmaceutical chemicals and preparations. These include acetic acid, calomel, chloroform, ether, glycerine, iodoform, tincture of chloride of iron, lime-water, saffron (*Crocus*), santonine, and sulphur. Forty-three per cent were found of good quality; 13.5 of fair quality; and 24.2 of inferior quality; and 19.3 not as called for, that is to say, substituted articles, as, when saffron (*Crocus*) was asked for, common safflower was sold. Fifty-three samples of stronger ether were examined. Of these, 20 were of good quality, 5 fair, 26 inferior. One sample was spirit of nitrous ether, and another the so-called "concentrated nitrous ether." As Dr. Tucker says, such errors as these are the grossest of blunders, and the consequence of such ignorant or careless sales might be most serious to the purchaser. As stronger ether is used as an anæsthetic, it ought to be of good quality. If the samples examined by Dr. Tucker represent the true condition of affairs throughout the world, it is not surprising that evil results sometimes follow the use of ether as an anæsthetic, as his results show that more than 50 per cent of the ether he tested was of inferior quality. Dr. Tucker expresses the opinion that the work done during the past two years has had a decided effect in improving the quality of the drugs sold throughout the State.

THE ADIRONDACK FORESTS.

As the majority of persons are interested in the preservation of our forests in the East, the arguments of *Garden and Forest*, in its issue of March 6, in favor of State control, will probably meet with some response. It is hardly likely that the direful picture which the writer of the article would bring before our mental vision will be realized; since the State of New York varies little in its commercial environment from New England, and in New England the tree-covered area has been on the increase for fifty years. So, while the constant change from freshet to drought may never be the fate of northern New York, yet the primeval forests may be gone as a pleasure-ground. The editor of *Garden and Forest* argues as follows:—

The complete destruction of the Adirondack forests is inevitable if existing conditions and methods of treatment are to continue. Unimportant improvements in the details of their management may be made from time to time; such improvements have been made within the last few years, and others are now proposed; but the processes of destruction are much more rapid and extensive than the effect of these comparatively insignificant means of amelioration, and there is at present no reason to expect that any effective provision will be made for the permanent protection of any part of this important region. Nothing can be done, indeed, without a thorough change in the system of control and administration of the forests on the State lands. The methods now pursued interpose no serious check to the influences which will extirpate the woods in a comparatively short time. If the devastation of the region, already far advanced, is completed, centuries of time will be required for any process of restoration.

The destruction of the North Woods will produce a change in the flow of the principal rivers of the State, and in the water-supply of the Erie Canal, which will cause widespread disaster to the interests of the people. There will be uncontrollable freshets at the times of heaviest rainfall, and when the snow melts in the spring; the channels of the rivers will be choked by *débris* brought down from the hills; and in summer, when a full volume of water is most needed, the flow will be insignificant. If this ruin is consummated, it will be a most serious blow to the prosperity of the State and of all classes of its people.

Not less important is the value of the region, in its relation to the health and life of the people of the country, as a place of resort for the inhabitants of the towns, and for all who need the restorative and vitalizing atmosphere and influences of a region of sylvan beauty and peace. As our population becomes more dense, the need and value of wild, rough tracts, incapable of cultivation, will be greatly increased. Beyond the arrangement required for the subsistence and comfort of the multitudes of visitors, no settlement or inhabitancy should be permitted in any part of the wilderness. If the forests are destroyed, the entire charm and attractiveness of the region will be eliminated, and a scene of hideous desolation will be substituted which no one will ever wish to look upon.

The only plan by which such injury can be averted, and means provided for the permanent conservation of these invaluable forests, is the acquisition by the State of the entire Adirondack region. While portions of it remain in the hands of private owners, injuries to State lands adjacent to their holdings cannot be prevented. But it would be senseless and wicked to expend the money which would be required for this purpose while the present system of control continues. It has proved entirely inadequate for the protection of the forests on the lands which already belong to the State, and it would be the extreme of folly to acquire property at great cost when there is danger that it might soon be dissipated and destroyed.

Unless a system of permanent control, under competent direction, can be put in operation, the people of New York may as well relinquish all thought of saving the Adirondack forests, and all interest in the subject. There can be no adequate or successful administration of a great forest-preserve while its management is subject to the possibility of frequent change, because it is treated as a portion of the political patronage of the State government. Unless the care of the forests on the State lands can be placed in the hands of men of such known and obvious character and quali-

fication for this work as will inspire general confidence, no system of administration can be successful, and competent men will not accept a place of such responsibility and importance while their work is always liable to interruption by the agencies of partisan politics. The inadequacy and failure of the present system of control and administration are inherent in the system itself, and are inseparable from its relation to partisan change and caprice. The evil is not to be remedied by merely changing the persons who administer a system which is essentially vicious.

If the people of the State of New York have enough regard for their own interests to lead them to insist upon the adoption of a system embodying the essential features of competent direction and security from partisan interference, it will be safe and wise to acquire the whole Adirondack region by purchase. If they have not this perception of the importance of the object in view, and of the means which are necessary for its accomplishment, the forests will be left to their fate. The methods now employed are wholly useless and ineffective.

THE UTILITY OF AGRICULTURAL EXPERIMENT STATIONS.

THE Hon. W. W. Wright, in a recent address on the past and present work and future prospects of the Geneva station, New York, took occasion to uphold the usefulness of such stations. The establishment of an experiment station by the State near Geneva within the last seven years challenged a great deal of curiosity among farmers and others, and is of late creating more and more of interest. To most people it was entirely new, nothing of the kind being nearer than adjoining States; and it may be said to be a modern invention, but cannot be called a "Yankee contrivance," for England, France, Germany, and other European countries, led off in the creation of these establishments within the present century, and had expended many millions of dollars in their organization and maintenance before any of the American States had established one. New York was among the last to avail itself of these institutions, though its wealth, extent of territory, and diversified agricultural interests, would naturally have made it the first. In one sense, such a "station" is no "experiment." In its organization, management, and the results to be expected, we have only to look to other civilized countries, which have had an experience, in some cases, of nearly forty years. When the Legislature of New York passed the law for creating this station, the significant fact was before us that neither in this country, nor in any other, had these stations been established, except they had fully answered the expectations of their projectors, and had been cherished and sustained, because their benefits were so manifest that there was no hesitation about continuing appropriations for their maintenance. Agricultural colleges, and classes in universities in which scientific farming was taught, were established or endowed in New York, but they cannot be said to have been successful. The most extensive of them was totally abandoned after a few years; whereas no experiment station has ever been discontinued, or diminished in the scope of its work, or embarrassed in the want of funds, in this country or Europe. On the contrary, in foreign countries they have been multiplied to an enormous extent, and have steadily increased on this side, though not so rapidly. There must be some reason for the success of these stations, and the total or partial failure of the colleges. The truth is, they are both schools, in which there is little difference in the abilities and qualifications of the teachers, but there is a vast disparity in the number and character of the students. In colleges we teach a few hundred boys, only a small percentage of whom will become practical farmers; while the stations are endeavoring to teach the same science to a whole community of men of all ages and conditions, engaged in the business of agriculture, not alone through lectures in which the relations of science and practical farming are explained, but through the agricultural press, and pretty much all newspapers now published and circulated in this country, daily, weekly, and monthly; and these are supplemented by bulletins giving in detail appropriate facts and statistics of the greatest interest to those who desire to become better informed in a business which occupies their constant thoughts, and in most cases the labor of their hands. Through these channels the stations reach the whole agricultural community. Nobody is too illiterate to participate in this knowledge, if he can read, or understand what others read to him. Nobody is too old to learn in this "school;" and he soon becomes almost unconsciously a teacher himself, for he imparts the knowledge he has thus acquired to others, in farmers' clubs and neighborhood gatherings, in the village tavern or post-office, at the country firesides, in the fields and on the highways, in an unpretentious but none the less effective and valuable way. He tests the theories of the professors, lecturers, and newspaper-writers by his invaluable practical knowledge and common sense, and often detects the errors into which theorists are always liable to fall, and thus renders valuable service to the true interests of agriculture. It may happen in this way that men who have never learned to read or write, but are capable of managing a farm well, may become valuable teachers in a limited sphere.

The first agricultural experiment station was established in Germany in 1851, and since that time the number of stations has steadily increased, until at present the number in the German Empire alone is given as 184. Careful statistics, including nearly every country of Europe, show that if New York should expend an equal amount, proportioned to the area of our territory, we should expend one million dollars annually. If, on the other hand, it were proportioned to our population, it would require an annual expenditure of three hundred thousand dollars before we should be on a level with the countries of Europe. The first station, as has been stated, was established in 1851 at Moeckern in Saxony; five years after, there were 6 stations in existence; five years later, 15; in 1866, 30; and in 1871, 56; since which time they have been even more rapidly increased.

Those who may perhaps regard the work done at Geneva as rather of scientific than practical value will be gratified to learn what work was entered upon and continued at this first station at Moeckern during the first six years of its existence. This is given in a summary recently prepared, comprised under twenty-six different heads. We select but a few of them: 1. Feeding-trials with sheep to ascertain the best maintenance rations; 2. Feeding-trials with cows, showing effect of coleseed-cake on yield of milk; 3. Feeding-trials on fattening sheep; 4. Observations on the yield of manure of cows and sheep, and the changes it suffers by keeping; 5. Comparison of feeding-value of grass, hay, and aftermath; 6. Observations on milk-production in passing from winter to summer feeding; 7. Effect of lupines on milk-production; 8. Composition and value as food of various kinds of distillery and brewery waste; 9. Feeding-trials with cows, oxen, and calves, the proper proportion of nitrogenous and non-nitrogenous food-elements for the three classes of animals, etc.

THE ENCOURAGEMENT OF HIGHER EDUCATION.[1]

THE choice of the 22d of February for the founder's day of the Johns Hopkins University will always be recognized as singularly appropriate. Historic associations, at once local and national, determined the choice.

It is a fact not generally known that the Father of his Country, before he became President of the United States, was the president of a Virginia college. When Washington was chosen to the office of chancellor of William and Mary College, succeeding the Bishop of London in that educational honor, he assured the board of trustees of his firm confidence "in their strenuous efforts for placing the system of education on such a basis as will render it the most beneficial to the State and the republic of letters, as well as to the more extensive interests of humanity and religion." Washington was always the friend of William and Mary College, his *alma mater*. Without forgetting local institutions in Virginia, he advanced during his eight years' presidency of the United States to what may be called the national idea in university education. From that idea Baltimore to-day can derive encouragement and inspiration.

Washington's grand thought of a national university, based upon individual endowment, may be found in many of his writings, but

[1] Abstract of an address by Professor Herbert B. Adams, Johns Hopkins University, Feb. 22, 1889.

the clearest and strongest statement occurs in his last will and testament. There he employed the following significant language: "It has been my ardent wish to see a plan devised, on a liberal scale, which would have a tendency to spread systematic ideas through all parts of this rising empire, thereby to do away local attachments and State prejudices, as far as the nature of things would, or indeed ought to admit, from our national councils. Looking anxiously forward to the accomplishment of so desirable an object as this is, in my estimation, my mind has not been able to contemplate any plan more likely to effect the measure than the establishment of a university in a central part of the United States, to which the youths of fortune and talents from all parts thereof may be sent for the completion of their education, in all branches of polite literature, in arts and sciences, in acquiring knowledge in the principles of politics and good government, and, as a matter of infinite importance in my judgment, by associating with each other, and forming friendships in juvenile years, be enabled to free themselves in a proper degree from those local prejudices and habitual jealousies which have just been mentioned, and which, when carried to excess, are never-failing sources of disquietude to the public mind, and pregnant of mischievous consequences to this country. Under these impressions, so fully dilated, I give and bequeath, in perpetuity, the fifty shares which I hold in the Potomac Company, . . . towards the endowment of a university, to be established within the limits of the District of Columbia, under the auspices of the general government, if that government should incline to extend a favoring hand towards it."

Here was the individual foundation of a national university. Here was the first suggestion of that noble line of public policy subsequently adopted in 1846 by our general government in relation to the Smithsonian Institution. The existence and ever-increasing prosperity of the Smithsonian Institution are standing proofs that private foundations may receive the fostering care of government without injurious results. Independent administration of scientific institutions may co-exist with State aid. It is a remarkable testimony to the wisdom of George Washington's original idea, that Andrew D. White, who, when president of Cornell University, happily combined private endowments and government land-grants, lately suggested in *The Forum* (February, 1889) the thought of a national university upon individual foundations. This thought is a century old, but it remains to this day the grandest thought in American educational history.

George Washington, like James Smithson, placed a private bequest, so that the general government might extend to it "a favoring hand;" but in those early days Congress had no conception of the duties of government towards education and science, and unfortunately the Potomac stock never paid but one dividend. George Washington's educational schemes were by no means visionary. His stock in the James River Company, which, like the Potomac Company, he had helped to organize, actually became productive, and was by him presented to Liberty Hall Academy, now Washington and Lee University. Washington raised Liberty Hall Academy to what he called "a seminary of learning upon an enlarged plan, but not coming up to the full idea of university." He meant to make it one of the three Virginia supporters of the university at Washington. Liberty Hall, or Washington College, his own William and Mary, and Hampden-Sidney, were all to be state pillars of a national temple of learning.

Was it not in some measure an historic, although an unconscious, fulfilment of that old dream of Washington, when, a hundred years later, Johns Hopkins determined to establish upon the Maryland side of the Potomac a university? Doubtless Johns Hopkins, like George Washington, had no very definite conception concerning the world-wide relations of a great modern university; but he saw as clearly as did the Father of his Country that the beneficent influence of higher education, if properly endowed, must reach far beyond the limits of a single State.

The Baltimore public has been accustomed to see or hear some new thing every year with regard to the number of students from this city, from Maryland, Japan, and each individual State of the American Union. The following facts represent a novel grouping of students according to the great sections of country from which they come. There have been some misapprehensions in our community concerning the region benefited by this university. Our new arrangement of statistics shows that during the present year there have been studying at this institution 98 graduates from the South, 47 from the West, 26 from the Middle States, 18 from New England. It is plain that this university is drawing college-men from the same sources as those from which Johns Hopkins drew his wealth; namely, from the South and West. In the undergraduate department there are now 139 students from the South, 18 from the West, 14 from the Middle States, and 4 from New England. Plainly, most of "our boys" come from the same sections of country as our graduates. The sum total of men from the South is 237; from the West, 65; from the Middle States, 40; from New England, 22. In short, the South has more than three and one-half times as many representatives as the West, six times as many as the Middle States, and more than ten times the number from New England. The total number from all the other States combined is nearly doubled by the South. About one-half of our entire student public comes from the State of Maryland. Considerably more than one-half comes from the three Southern States which Johns Hopkins wished especially to benefit. From this brief review of statistical facts, four points are clear: first, the intent of our founder has been realized; second, the South and the West are chief sources of our student-supply; third, in these directions are the lines of least resistance and greatest influence for the Johns Hopkins University; fourth, one-half of our student public comes from other States than Maryland, — a fact indicating that the local idea is happily balanced by the national idea.

There are pleasing evidences of internationality in the life and influence of the Johns Hopkins University. Some of our professors came hither from England and Germany. Almost all the members of our faculty have studied at one time or another in European institutions. The annual register for 1888 shows twelve students from Canada, seven from Japan, and one representative from each of the following countries: China, England, Germany, Mexico, Italy, and Russia.

Of the graduates, we see Westerners called eastward to college positions, Northerners called southwards, and Southerners called northwards. The president and trustees of the Johns Hopkins University have established here a national university upon a local and individual foundation.

How can the foundations of a national university, resting upon individual endowment, be further strengthened? Simply by extension and more endowments of the same sort. A great university grows, as a great city grows, by the individual association of property investments along avenues already opened. There are men who dream of founding towns and universities apart from existing centres of population and capital; but he is a wise founder who, like George Peabody, Johns Hopkins, or Enoch Pratt, recognizes the vantage-ground of a noble city, and plants there institutions which will work together through coming ages. The principle holds with reference to individual endowments for the higher education. They always accomplish the most good when they are connected with some central foundation which gives them at once stability, unity, and individuality, as in the associated institutions of a large city.

Extension by private philanthropy is the manifest destiny of the Johns Hopkins University. There will perhaps be the individual endowment of a college; perhaps of a university library, bearing the name of the giver, like the Andrew D. White Library at Cornell University; of a laboratory, a museum, or an observatory, like those at Harvard or at the University of Virginia. Some day we ought to have an art-gallery like that at Yale. What is most needed, however, is a central academic building and library to shelter fitly the "fair humanities," — the studies of ancient and modern literature; philosophy and ethics; history, politics, and social science. Baltimore, in the course of time, will have as many foundations, bearing individual names, as there are now in the older institutions of the country. Glance through the catalogues of Harvard, Yale, Princeton, or the University of Virginia, and see the great host of private bequests, some large, some small, but all of them carefully guarded and applied to specific objects, such as the increase of the library or the support of scholarships and fellowships. There may be as much individuality in a great university

establishment as there is in a street or a city bearing a great man's name, like Washington Place or Baltimore.

This is an era of educational endowment upon a generous scale. The most recent published report of Col. Dawson, the commissioner of education, shows that the sum total of noteworthy educational gifts during the year 1886–87 was nearly five million dollars. More than two-thirds of the entire amount was distributed among nine institutions, four of them collegiate, one academic, three professional, and one technical. The institution most highly favored was Harvard University, which received from individual sources nearly a million dollars. From one man came a legacy of $630,000. Our nearer neighbor, Haverford College, supported by the Society of Friends, received $700,000 in one bequest. Of the 209 gifts recorded by the commissioner of education, 25 represent $50,000 or more, 72 were sums between $5,000 and $49,000, and 112 were sums less than $5,000. The most striking fact in all this record of philanthropy is that such a large proportion of the entire amount, fully two-thirds, was given to higher education. The year 1888 is richer than 1887 in individual bounty to institutions of learning. Nearly ten millions were given by three persons for the encouragement of manual training, etc., but there are rumors of even larger benefactions for university endowment. The collective returns for 1888 are not yet published, but it is certain that the past year will surpass any hitherto recorded in the annals of American education.

Whatever forms modern philanthropy may take, one thing is certain, universities are not likely to be forgotten. While the Johns Hopkins University undoubtedly has most to expect from private philanthropy, like that which has already built up the city, it is not beyond the bounds of possibility to hope that the State of Maryland may some day extend to our institution what George Washington modestly called a "favoring hand." At present this State, by the exercise of its taxing power, takes from the Johns Hopkins the sum of nearly $11,000, and from the Johns Hopkins Hospital the sum of $33,000, a year. From our original patrimony Baltimore County took a collateral inheritance tax of $36,000.

The exemption of college property, even the property of professors, from taxation was well-nigh the universal custom in the English colonies of North America. To this day, Maryland exempts from taxation all buildings, furniture, equipments, and libraries of incorporated educational or literary institutions, with the land appertaining to them; in other words, all unproductive property actually in use for educational purposes. This principle of exempting the property of institutions of learning is so thoroughly embedded in the constitutional, statutory, and customary law of almost every State in the American Union, that such exemption may be recognized, like the principles of Roman law, as sovereign common sense. But some American States go much further, and exempt the productive property of colleges and universities, their savings and investments, the income of which is applied to educational objects. The personal property and real estate belonging to educational institutions are exempt from taxation in each of the following States: Maine, Vermont, Rhode Island, Virginia, Kentucky, Kansas, and Nebraska, and probably in others whose statutory laws permit exemption but whose customs and policy vary.

Exemption from taxation is a manifest duty which the State of Maryland owes to an institution which is now using all the income from its productive capital, as well as its buildings, books, and apparatus, for the higher education of Maryland youth. Indeed, one might go further, and say that the Johns Hopkins is doing for Maryland what most States endeavor to secure by large annual appropriations. This institution is to-day discharging the functions of a State university, and is paying for the privilege of providing what is usually regarded as the duty of the State to provide.

The encouragement of higher education by government aid, in one form or another, has been a recognized principle of public policy in every enlightened State, whether ancient or modern. Older than the recognition of popular education as a public duty was the endowment of colleges and universities at public expense for the education of men who were to serve Church or State. It is a mistake to think that the foundation of institutions by princes or prelates was a purely private matter. The money or the land always came from the people in one form or another, and the benefit of endowment returned to the people sooner or later. Popular education is the historic outgrowth of the higher education in every civilized country, and those countries which have done most for universities have the best schools for the people. It is an error to suppose that endowment of the higher learning is confined to Roman and German emperors, French and English kings. Crowned and uncrowned republics have pursued the same public policy. Indeed, the liberality of government towards art and science always increases with the progress of liberal ideas, even in monarchical countries like Germany ,where, since the introduction of parliamentary government, appropriations for university education have greatly increased. The total cost of maintaining the Prussian universities, as shown by the reports of our commissioner of education, is about two million dollars a year. Only about nine per cent of this enormous outlay is met by tuition-fees. The State contributes all the rest in endowments and appropriations. Prussia now gives to her universities more than twice as much as she did before the Franco-Prussian war, as shown by the report of our commissioner at the Paris Exposition in 1867. In that year France gave her faculties of higher instruction only $765,764. After the overthrow of the second empire, popular appropriations for higher education greatly increased. The budget for 1888 shows that France now appropriates for college and university faculties $2,330,000 a year, more than three times the amount granted under Louis Napoleon. The little republic of Switzerland, with a population of only three millions, supports four state universities, having altogether more than three hundred instructors. Its cantons, corresponding upon a small scale to our States, expend over $300,000 a year upon the higher education. The Federal Government of Switzerland appropriated, in 1887, $115,000 to the polytechnicum, and $56,000 in subsidies to cantonal schools, industrial and agricultural, besides bestowing regularly $10,000 a year for the encouragement of Swiss art. The aggregate revenues of the colleges of Oxford, based upon innumerable historic endowments, public and private, now amount to fully two million dollars a year. The income of the Cambridge College endowments amounts to quite as much. But all this, it may be said, represents the policy of foreign lands. Let us look at home, and see what is done in our own American commonwealths.

Maryland began her educational history by paying a tobacco-tax for the support of William and Mary College. This colonial generosity to another State has an historic parallel in the appropriation of a township of land by Vermont for the encouragement of Dartmouth College in the State of New Hampshire, and in the corn that was sent from New Haven to the support of young Harvard. In colonial days Maryland had her county schools, some of them classical, like King William's School at Annapolis. All were founded by authority of the Colonial Government, and supported by aid from the public treasury. The principle of State aid to higher education runs throughout the entire history of both State and Colony.

The present generation has not been so generous to the cause of higher education as were the fathers of the State; but nevertheless Maryland, in her entire history, has appropriated something over $650,000 for what may be strictly called college education, not counting $60,000 given to the State Agricultural College, nor $40,000 proceeding from State lotteries. While this collective bounty is small, it is money given by voluntary taxation, and not taken from institutions of learning. Most of the amount was raised in times when the State was poor or heavily in debt, and when public money came with difficulty. Moreover, this financial generosity of Maryland establishes the principle for which we are contending; namely, that this State, like all other enlightened States in the world, has recognized the duty of support to higher and unsectarian institutions of learning. She has at different times appropriated $650,000 to colleges and the University of Maryland from her public treasury.

Let us now inquire what other States in the American Union have done for higher education, always recognizing of course great inequality in State population and in the taxable basis.

Virginia, whose earliest educational foundations Maryland helped to lay by her tobacco-tax, has expended upon colleges and univer-

sity over two million dollars during her history as a State, not counting the colonial bounty to William and Mary. Since the war, Virginia has given her university $40,000 a year. Before the war, she gave $15,000 a year. The original university establishment cost the State about $400,000. The State of South Carolina was Jefferson's model for generous appropriations to the cause of sound learning. She has given two million and eight hundred thousand dollars to that object. Georgia has given $938,000 for the same purpose. Louisiana has given $794,000 from her State treasury for the higher education in recent years, and, according to the testimony of her own authorities, has distributed over two millions among schools, academies, and colleges. Texas has spent upon college education $382,000, and has given for higher education two and one-quarter million acres of land. The educational foundations, both academic and popular, in the Lone Star State, are among the richest in America.

Turning now to the Great West, we find that Michigan has given over two million dollars to higher education. She supports a university which is as conspicuous in the North-west as the University of Virginia is in the South, upon one-twentieth of a mill tax on every dollar of taxable property in the State. That means half a cent on every hundred dollars. This university tax-rate yielded last year $47,272. Wisconsin pays one-eighth of a mill tax for her university, and that yields $74,000 per annum. Wisconsin has given for higher education $1,200,000. Nebraska is even more generous to her State university: she grants three-eighths of a mill tax, yielding about $60,000 a year. The State of California grants one-tenth of a mill tax, which yielded last year over $76,000. Besides this, the University of California has a permanent State endowment of $811,000, yielding an annual income of $52,000, making a total of $128,000 which the State gives annually to its highest institution of learning. Altogether California has expended upon higher education two and one-half million dollars.

It is needless to give further illustrations of State aid to American universities. These statistics have been carefully collected from original documents by one of our historical students, who are making important contributions to American educational history, to be published by the United States Bureau of Education. The principle of State aid to at least one leading university in each commonwealth is established in every one of the Southern and Western States. In New England, Harvard and Yale and other higher institutions of learning appear now to flourish upon individual endowments and private philanthropy; but almost every one of these collegiate institutions, at one time or another, has received State aid. Harvard was really a State institution. She inherited only £800 and 320 books from John Harvard. The towns were taxed in her interest, and every family paid its peck of corn to make, as it were, hoecake for President Dunster and his faculty. Harvard College has had more than half a million dollars from the treasury of Massachusetts. Yale has had about $200,000 from the State of Connecticut. While undoubtedly the most generous gifts have come to New England colleges from private sources, yet every one of them, in time of emergency, has come boldly before representatives of the people, and stated the want. They have always obtained State aid when it was needed. Last year the Massachusetts Institute of Technology became somewhat embarrassed financially, and asked the Legislature for $100,000. The institution got $200,000, twice what it asked for, upon conditions that were easy to meet.

Can the State of Maryland and the friends of the Johns Hopkins ignore the abundant testimony in favor of the encouragement of university education, not only by exemption from burdensome taxation, but by positive appropriations? If occasion arises, it will be proper and legitimate for the friends of this institution to go before the people of Maryland and say what is needed. Private philanthropy will do all it can, but public interest demands that the State should do its part by throwing off needless taxes, and settling for what it has already taken away.

Do you say that all this would lead to meddlesome interference by the politicians? That is what everybody said when a university was founded by the Prussian Government in Berlin. That is the stock argument against all State universities. But there stand to-day Berlin and all the German universities firm and untroubled upon state foundations. The whole South and the entire West are full of educational establishments by the State. Some of them, like the Universities of Virginia, Michigan, and Wisconsin, are beacon lights of intelligent and non-partisan administration. Have Washington politicians done any harm to the Smithsonian Institution? On the contrary, they have indirectly increased its economic power by appropriations amounting to nearly two million dollars. They allow the secretary of the Smithsonian to direct the expenditure of $220,000 a year. Congress allows the Smithsonian to be managed by a board of regents composed of distinguished college presidents and public men of spotless integrity. Amid all the changes in the civil service, no man has ever been displaced for political reasons from either the Smithsonian Institution or the National Museum. These facts are stated upon good authority.

What are the serious thoughts that have been emphasized in this address?

1. The Johns Hopkins is now a truly national university upon local and individual foundations.

2. This noble institution which benefits Baltimore, Maryland, and the whole country, especially the South and West, can be strengthened most efficiently by further local and individual endowments.

3. The examples of history at home as well as abroad show that States encourage universities by wise exemption from burdensome taxation and by generous appropriations, if original endowments and private philanthropy prove inadequate.

4. The development of public opinion, based upon a knowledge of present facts and upon existing relations of this university to Baltimore and Maryland, is the best way to encourage higher education in this city, in this State, and in this country.

BOOK-REVIEWS.

The Government of the People of the United States. By FRANCIS NEWTON THORPE. Philadelphia, Eldredge & Brother. 12°. 90 cents.

WORKS on the American system of government multiply apace; and, if their quality was always good, our young people would have superabundant means of information about their public duties. Candor compels us to say, however, that the treatise now before us is defective in some very important respects. Its chief fault is that it attempts too much. It undertakes to describe not only the Federal Government, but also those of the States, towns, and counties, and in addition to relate the history of constitutional government from the landing of the Anglo-Saxons in England to the present time, all in the space of little more than two hundred pages. The necessary consequence is, that, in spite of condensation and brevity of expression, no part of the work is thoroughly done. The least satisfactory part, as might be expected, is that relating to local affairs; the town and county governments differing so widely in different States, that no single description will apply to them all. For instance: Mr. Thorpe says that the school directors of the town levy the school taxes, that the selectmen make the local laws and ordinances, that the county has the care and support of the poor, and that there is a county superintendent of schools; but, though these statements may be true of his own State of Pennsylvania, they are wholly untrue of Massachusetts. As for the history of constitutional government, which occupies the introductory part of this book, that obviously requires a separate work; and the chapters here given to it are altogether inadequate. We may add that the book contains a facsimile of the Declaration of Independence, several fancy pictures of historical events, and a gaudy spread eagle for frontispiece, none of which are likely to contribute much to political education.

A Text-Book of Elementary Biology. By R. J. HARVEY GIBSON. London and New York, Longmans, Green, & Co. 16°. $1.75.

MR. GIBSON'S experience as a teacher of biology has satisfied him, that, in order to instruct the student in this most important department, the beaten track must be left, and a new departure taken. To properly appreciate it, and to benefit by its study, a student must first undergo a preliminary training in the facts and

conclusions of physics and chemistry, and, in addition, must devote not a little time and labor to studying the application of the more general laws of these sciences to the special phenomena of plant and animal life. In this text-book the author has summarized briefly the principal conclusions of the inorganic sciences, devoting special attention to those laws on which the higher science of biology is founded, and has endeavored to keep prominently in the foreground the dependence of biology on physics and chemistry, and the relationship of morphological and physiological details to general principles.

Matter, energy, the classification of chemical compounds, and the laws of chemical change, are discussed in the first chapter; and the author then proceeds to consider protoplasm in its many and varied aspects. Individual and tribal life, with distribution and classification, are thoroughly treated.

The *Proteita*, *Protophyta*, *Protozoa*, *Metaphyta*, and *Metazoa* are described in most minute detail. The illustrations are excellent, and are to a great extent original. The typography and general execution of the book leave nothing to be desired. As a text-book of elementary biology, it is one of the best that have ever been published.

Chemical Lecture Notes. By PETER T. AUSTEN. New York, Wiley. 12°. $1.

THIS book is not intended as a text-book, but is simply a collection of notes and observations on certain topics, which, experience as a teacher of chemistry in Rutgers College and the New Jersey State Scientific School has shown Professor Austen, give the student more or less trouble. While no attempt has been made to include all the rocks and shoals on which chemical students suffer shipwreck, still the author has succeeded in making lucid many of the topics which are not rendered sufficiently intelligible by the average text-book. Valence, atomicity, the laws of Boyle, Charles, and Mariotte, can no longer be a mystery to a student of these lecture-notes. We recommend them to those who have found difficulty in comprehending the intricacies of modern chemistry, and equally to those who would escape the hard places in this science, so numerous even when studied with the best of helps and teachers.

AMONG THE PUBLISHERS.

WE have received from A. Lovell & Co. "Greene's Language Half-Blanks, No. 1," by H. R. Greene, a pamphlet designed to teach the elements of English grammar by means of exercises and diagrams. Examples are given of the parts of speech, and the construction of the sentence is duly explained, and the pupil is then to write short sentences, the principal words being furnished him to illustrate what has been told him. These sentences are to be arranged in tables, and the different elements of the sentence indicated by certain marks written under the words. What the precise value of Mr. Greene's system may be, experience must decide; but marks and diagrams have no connection with language as such, and can at best be nothing more than very slight helps. The book is one of a series ending with a full grammar.

— Messrs. Ginn & Co. of Boston have issued "An Introduction to the Poetry of Robert Browning," by Professor William J. Alexander of Halifax, N.S. The author remarks on the difficulty experienced in understanding any new writer, and on the special difficulty of understanding Browning because of his obscurity; and he has prepared this work with the object of clearing up some of these difficulties, and making his author more comprehensible to the mass of readers. He finds the chief motive of Browning's work in his belief in the central doctrines of Christianity, which he has endeavored to illustrate and enforce. One chapter is given to Browning's philosophy, and another to his theory of art; and the remainder of the book is devoted to an account of his mental development as exhibited in his various works.

— D. Appleton & Co. will publish immediately a treatise by the Hon. Seymour Dexter of Elmira, N.Y., on "Co-operative Savings and Loan Associations," which will include an examination of building and loan associations, mutual savings and loan associations, accumulating fund associations, co-operative banks, etc. The appendix will contain laws of New York, Pennsylvania, and Massachusetts, forms for Articles of associations, by-laws, account-books, and other useful information on the subject. The author, who is judge probate of Chemung County, has been president of the Chemung Valley Mutual Association for fourteen years, and is high authority on the subject of which he treats. They also announce "A Manual of Instruction in the Principles of Prompt Aid to the Injured," designed for military and civil use, by Dr. Alvah H. Doty; and a new book by Mr. O. B. Bunce, entitled "The Story of Happinolande and other Legends," which is to be issued in the Gainsborough Series. The latter consists of four slight sketches, — "The Story of Happinolande" (which, being translated, is "Happy-no-land"), "A Millionnaire's Millions," "The City Beautiful," and "John's Attic;" all of which, the latter, however, only slightly, involve questions in social science.

— Harper & Brothers have ready this week a concise instructive work on "Constitutional Government in Spain," by J. L. M. Curry, LL.D., predecessor of Mr. Perry Belmont as minister of the United States in Spain. It is the result of some years of close study of the subject, and of actual observation of Spanish political and social life during the author's official residence in the country. Valuable appendices are added, summarizing the careers of aspirants to the Spanish throne, — Fernando, Leopold, Duke of Montpensier, and Amadeo; giving sketches of Christina, Isabel, Alfonso XII., the Infantas, the Queen Regent, and Alfonso XIII.; describing the present condition of Spain in its political, social, and industrial aspects; and, lastly, explaining briefly the acquisition of Florida by the United States. They have also just ready "Choice Cookery," by Catherine Owen, author of "Ten Dollars Enough," etc., the object of which is to help those who wish to know at a glance what is newest and best in modern cookery.

— David McKay, Philadelphia, will shortly publish a new edition of Joel Cook's "Holiday Tour in Europe," formerly published by Porter & Coates.

— The *American Magazine* suspended publication last December.

— *The Index*, published by E. R. Walker, Chicago, is a little four-page monthly paper that will attempt to take "a glance at the leading features of the forthcoming periodicals."

— *Once a Week* has been enlarged, and includes a greater variety of contents. The most noticeable thing in the current number is the first instalment of a Stockton story, called after its heroine, "Ardis Claverden."

— *The Advance Sheet*, published by C. A. Watson, New York, will attempt to give a monthly survey of periodical literature, indexing the contents of the leading periodicals for the next month, with such comments as will make the announcements as attractive as possible.

— The two new volumes of "Letters of Carlyle" which Professor C. E. Norton has edited are mostly addressed to the various members of Carlyle's family, and afford a tolerably continuous account of his life from his marriage to the period when his fame was about to be established by the publication of his "French Revolution." Messrs. Macmillan are to publish them speedily.

— The new edition of Queen & Co.'s "Chemical Apparatus Catalogue" is now published. It contains 368 pages, with about 1,200 illustrations, and will be mailed to any address on receipt of fifty cents, which sum will be deducted from the first purchase made from it amounting to ten dollars or more. This is a very elaborate work, containing the most useful apparatus, and the firm feels confident that it will be considered by chemists a standard for reference. While the quality of the apparatus is maintained, most of the prices have been reduced.

— In the *Contemporary Review* for March (New York, Leonard Scott Publication Company), interest centres in the paper on the "Panama Canal," by Edward Whymper, with its intelligent diagrams and maps; Archibald Forbes criticises some of Lord Wolseley's recent utterances; Dr. Dale continues his interesting papers on Australia; Canon Wilberforce treats of Ireland's demands; and Mr. Clerke describes the observatory at the Cape of Good Hope.

— The favorable reception accorded in the past to the Easter-card packets put up by H. H. Carter & Co., Boston, has encouraged this enterprising house to prepare their 1889 packages with even greater care than heretofore. Being one of the largest dealers in this class of goods in the country, and selling paper directly from the mills, they are enabled to give exceptionally good values. People dealing with them are sure to find their goods satisfactory.

— Contortionists and "Snake-men" will be described in the April *Scribner* by Dr. Thomas Dwight of the Harvard Medical School, who has made a thorough investigation of their peculiar anatomy. Photographs of several expert contortionists in their most wonderful feats will be reproduced in the article. Henrik Ibsen, the Norwegian dramatist, a literary genius little known in this country, is the subject of a paper in the same number. Charles Francis Adams's paper on "The Prevention of Railway Strikes" was written nearly three years ago, but held back by the author for fear that, in existing conditions, it might result in more harm than good. A practical scheme for giving employees a part in the management of the road is suggested. Pictures showing stages in the building of the great ocean steamers, the "City of New York" and others, will illustrate Mr. Rideing's article on "Ocean Greyhounds."

— At a regular meeting of the Nineteenth Century Club, New York, on the 9th of November last, a resolution was passed appointing a committee to prepare and publish a memorial volume to the founder and first president of the club, and to solicit subscriptions to defray the expenses. This volume is now ready for publication. The book will contain the funeral orations, the addresses delivered at the memorial meetings, and essays and letters since received. It will consist of about two hundred pages, octavo, printed on heavy Holland paper, and richly bound in levant morocco. This edition, upon which no pains or expense will be spared to make it worthy of the club and of the occasion, will cost five dollars per copy. For those who desire it, an edition, handsomely bound in cloth, will be supplied at a cost of three dollars per copy. As frontispiece there will be a portrait of Courtlandt Palmer. As the committee have decided to print only such copies of the memorial volume as are ordered in advance, it is desirable that no time should be lost in notifying John H. Beach, 25 East 57th Street, of the number of copies and the kind of binding which may be desired.

—Mr. Andrew Lang is a frequent contributor of leading articles on social and literary topics to the *London Daily News;* and some of his admirers think that not a little of his most characteristic writing is to be found in these "leaders," as the English call them. One of these admirers, with the author's permission, has gathered some thirty of these essaylets in a volume which Longmans, Green, & Co. will publish shortly, under the apt title of "Lost Leaders." Among the subjects treated are "Thackeray's Drawings," the "Art of Dining," "Phiz," "Amateur Authors," and the "Lending of Books."

— James W. Queen & Co., 924 Chestnut Street, Philadelphia, announce a clearance sale of microscopes, objectives, accessories, and sundries, and have issued a new catalogue. The firm's stock-taking strongly calls attention to the fact that some microscopical accessories (and other goods) have not shown, of late, such activity of commercial movement as is desirable. They have therefore picked them out, described them in their special catalogue, and cut the prices, to make them move along. The articles described in this list are new and perfect unless otherwise noted.

— The following are from the table of contents of the April number of *The Chautauquan:* "Gossip about Greece," by J. P. Mahaffy, M.A., of Dublin University; "Agesilaus," by Thomas D. Seymour, M.A., of Yale University; "Greek Art," by Clarence Cook; "Color in the Animal World," by the Rev. J. G. Wood; "What Inventors have done for Farming," by James K. Reeve; "The Care of the Insane," by A. G. Warner, Ph.D.; "Sunday Labor," by the Rev. Jesse H. Jones; "The First Presidential Inauguration," by Charles Carleton Coffin; "English Pronunciation," by Robert McLean Cumnock, of Northwestern University; "Student Life in Paris," by F. M. Warren; "British Columbia," by Sheldon Jackson, D.D., United States general agent of education in Alaska; "Women's Clubs in London," by Susan Hayes Ward; "A Virginia Plantation," by C. W. Coleman; "The Secret Service of the Treasury Department," by Mrs. Carl Barus.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

Origin of Fish in Isolated Waters.

A FEW months ago I called attention to the abundance of fish in certain isolated ponds in Florida, which become dry at times. (*Science*, xii. p. 280). Mr. Henry W. Howe of Boston suggested in reply that fish may be transported from one pond to another by birds. This is an interesting suggestion, as indicating a possible explanation, though I am not aware that there is any evidence to that effect at present. Alligators might also be mentioned as a possible transporting agency. But any such means would seem to be inadequate to produce the observed results. Since my former communication, I have had further opportunity to investigate this subject. The past season in Florida has been a very unusual one. The rainy season, which usually begins in the peninsular portion of the State, about the 1st of June, failed to make its appearance, and a severe drought resulted. Ponds, swamps, creeks, and wells became dry. Then in the fall, when the rainy season usually closes, "the windows of heaven were opened," and a very wet fall and winter followed. But the ponds, which were dry for many weeks during the hottest part of the year, now swarm with little fish; and during the heavy rains fish could be seen not only in ponds, but in ditches beside the railroad, in ditches beside the fields, and in shallow rain pools which would dry in a few days, and had no connection with other waters. In fact, minnows have been almost abundant enough to give color to the old notion of the *raining-down* of fish, frogs, tom-cats, lean meat, etc., reports of which are occasionally seen in the newspapers. There is certainly some certain and rapid means of populating the waters of isolated and temporary pools, which is well worth investigating.

CHS. B. PALMER.

Orange Heights, Fla., March 11.

The Soaring of Birds.

I HOPE I may be allowed space for a few short comments on Messrs. Gilbert and Kimball's letters in *Science*, xiii. pp. 169 and 170.

My conception of relative velocity does not differ from Mr. Gilbert's, as he supposes, and accordingly the statements of his paper were as clear to me as the restatements of his letter. So far as his presentation of the differential motion theory of soaring is concerned, my only criticism was that his assumption as to the dynamical effect of the wind on the bird during the turn seemed to demand more than mere assertion. One of my statements as to what this assumption implied, Mr. Gilbert questions as follows: "I do not admit 'that during the turn his [the bird's] velocity relative to the earth will change by an amount equal to twice the velocity, relative to the earth, of the medium in which the turn is made.' His velocity relative to the earth will change by an amount equal to twice his velocity relative to the medium." Both positions are correct, however. We are merely using the term "velocity" in different senses, — Mr. Gilbert as connoting both rate and direction of motion, I as connoting rate of motion simply. I used the term in this sense, because it was the sense in which Mr. Gilbert had used it when he asserted that the velocity of the bird relative to the air would be the same after a turn as before.

Both Mr. Gilbert and Dr. Kimball hold that the velocity of wind or bird relative to the earth "has nothing to do with the question." That surely depends, however, upon what the question is. If we undertake, as I did, to account for the fact that some birds are able, without flapping of wings, to describe paths which, *relatively to the earth*, are spirals about lines inclined upwards, velocities relative to the earth must be taken into consideration. If, how-

ever, the question is the somewhat simpler one of determining the conditions under which a bird can gain elevation without expending energy, velocities relative to the earth may, of course, be ignored.

There is, as I now see, a great advantage in making the simpler investigation first: for, as Dr. Kimball has clearly shown, as soon as we recognize the fact that the bird's motion relative to the medium depends only on their relative velocity, it becomes clear that gain of elevation, and consequently the whole phenomenon of soaring, is impossible in a uniform horizontal wind.

It follows that there was an error in my theory of soaring. Mr. Gilbert thinks it due in part to my assuming it to be possible for a bird to glide in a wind moving faster than itself, with its head to leeward; but I see no reason why birds should not accomplish this fact, and am satisfied that I have often seen them do it. He also holds that my bird, "in passing from a negative velocity relative to the air, to a positive velocity relative to the air, must pass through the phase of no velocity relative to the air, in which he is practically helpless." But I was dealing with the bird's component velocity in the line of the wind's motion; and he might always have a velocity relative to the air, though its component in that line might be zero. The error which I made was in assuming, that, under the conditions of flight to which I subjected my bird, the turn to leeward was possible. From the way in which I made him fly, it is clear that the resultant force exerted on him, at every point of his supposed path, must be upward and to leeward. That being the case, the turn to leeward could not be accomplished, and consequently the path he was supposed to describe was an impossible path.

I feel that I must apologize to those of your readers who may have followed me in what may fitly be called "a wild-goose chase."

J. G. MACGREGOR.

Dalhousie College, Halifax, N.S., March 8.

"Shall We Teach Geology?"

IN Professor Winchell's remarks on my review of his recent work, there are only two points that call for reply. First, as to the study of history, which, according to him, trains no faculty but verbal memory. He now says that his "criticisms on history contemplate it as a study urged upon children in the early stages of education," and that in the colleges it is pursued in a better way. But, even if imperfectly taught, history trains far more important faculties than verbal memory. It exercises the intellect generally quite as much as geology does, and it also calls into play the moral judgment and the sympathies, which geology does not. To Professor Winchell the old red sandstone may be a more important topic of study than the Roman Empire, and the plesiosaurus a more interesting object of contemplation than Washington or Columbus; but to the mass of men this is not so. As to the time that Professor Winchell would have spent on geology, I may have misapprehended his meaning; and, if so, I am glad to be corrected I haven't his book by me at present; but, if I remember rightly, he says that the study ought to be taken up in the primary schools, and *continued through the various grades*, which I understood to mean that the subject should be studied more or less every year. He now says that he only wants it taken up several times at intervals, and not pursued continuously, which is more moderate. I do not see, however, how even so much study of geology is possible; because, not to speak of languages and literature, there are many sciences of greater importance than geology, which ought, therefore, to be studied first. Such are arithmetic and geometry, geography, physics, human physiology, psychology, ethics, civil polity, and history; and I do not see how even all of these can be taught in the public schools. If these views are correct, geology can be nothing but an optional study in the high schools and colleges, while in the lower schools it can have no proper place.

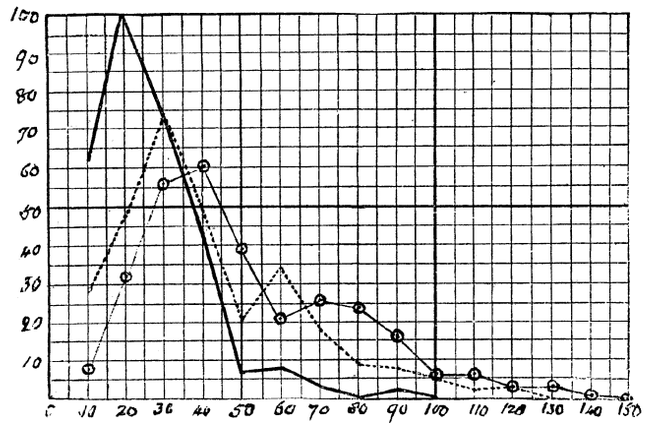
THE REVIEWER.

Curves of Literary Style.

IN the interesting researches on this subject by Professor Mendenhall described in your journal in 1887, words were classified according to the number of letters in them, and curves made accordingly. As he pointed out, there are many ways in which the principle of his method may be applied; and I have lately thought some instructive results might be obtained from examining sentences with regard to length, as measured by the number of words.

Length of sentences is a matter in which pronounced styles differ greatly. Doubtless this is associated with psychological peculiarities which it might be instructive to inquire into. The mental machine (so to speak) which, for example, turns out the long parenthetical sentences of Gladstone, must be very different in design from that which yields the simple and direct utterances of John Bright.

I have made an examination of 300 sentences in each of the following works: Carlyle's "French Revolution," De Quincey's "Confessions," and Johnson's "Rambler." The number of words in each sentence was counted, and the sentences grouped accordingly. Then the sentences with words up to 10 were added together, those with words from 10 to 20, from 20 to 30, and so on. The accompanying curves were then obtained from these data. Let it be clearly understood what they mean. The plain line curve (for Carlyle) means that in the 300 sentences of the passage selected there were 62 containing words varying in number up to 10, while 100 had from 10 to 20, and so on. The result is roughly as we might expect: short sentences form the bulk of the Carlyle passage, his maximum being in the class 10 to 20, and sentences of more than 50 words are comparatively few. There are none beyond 100. De Quincey and Johnson, on the other



CURVES OF STYLE FROM CARLYLE, DE QUINCEY, AND JOHNSON.
Carlyle, heavy line; De Quincey, broken line; Johnson, light line with dots.

hand, have an abundance of longer sentences. De Quincey's most numerous class is that of 20 to 30 words; Johnson's, 30 to 40. But the curve of the former does not die down till after 110 to 120 words (really there was one inordinate sentence of 170, not shown in the diagram); while Johnson's is further protracted to 130 to 140.

I do not affirm the constancy of these curves: they only apply to the specified passages of 300 sentences. These few lines are merely by way of suggestion, and should any reader have the time and patience to pursue the inquiry further, he might, I think, find his labors not without some useful results.

It might be useful to see in what degree these curves approximate to constancy, or come short of it. One would like to know better than we do at present, how far the method, in any of its forms, is reliable or helpful in settling disputed questions of authorship, or in tracing anonymous literature to its source.

I would suggest an examination of the words used by speakers or writers as likely to be instructive. A. B. M.

London, March 7.

Wind-Velocity and Wind-Pressure.

FROM time to time there have appeared discussions of these questions, so important to the practical engineer. It seems probable that the first of these, as far as relates to the relation between wind-movement and the travel of the cups of Robinson's anemometer, is soon to be definitely settled by indubitable experiments.

Professor Robinson first considered that the cups moved with one-third the wind-velocity, but this has been repeatedly called in question. In later times the more common method of investigation has been by whirling the anemometer on arms from 11 to 35 feet in length. It would seem as though arms of 11 feet could hardly give satisfactory results.

In discussions of this relation, the utmost confusion has arisen by wrongly considering the so-called "anemometer factor," and by making the same an entirely different quantity, and one from which it was supposed a "friction constant" had been separated. The statement that anemometers used in this country give 20 per cent too great wind-movement has been based on this misconception. Let $x =$ "anemometer factor," $w =$ wind-movement, and $v =$ travel of the cups: we have,

$$x = \frac{w}{v} \qquad (1)$$

Let $a =$ "friction constant," and $b =$ another constant: we have,

$$w = a + bv \, (2)$$

Substituting the value of v in (1), we have,

$$x = \frac{b\,w}{w - a} \, (3)$$

In experiments at St. Petersburg it was found that an anemometer with 6.72-inch arms and 4-inch cups, the same as used in this country, had $b = 2.47$, and $a =$ about 2 miles per hour. Assuming w at various velocities (5, 10, 15, 20, and 25), we obtain from (3), for x, 4.12, 3.09, 2.85, 2.74, and 2.68 respectively.

We see that even these earlier investigations show our anemometer (with factor 3) almost exactly correct for velocities from 10 to 15 miles per hour, while at less velocities it gives too little wind, and only about 12 per cent too much at 25 miles.

The wind records of this country had been so often called in question, the chief signal-officer finally made provision for an investigation of the question. The results in full will shortly be published. For our present purpose it will suffice to give the approximate results with our own anemometer, described above: with w at 5, 10, 15, 20, and 25, we obtain for x, 3.30, 3.11, 3.05, 2.98, and 2.89 respectively. These are very satisfactory, and show, that, except for high or low winds, the records are entirely correct.

It is rather singular that investigations have recently been made in England with a whirling arm of 29 feet, almost the same as that used in this country (28 feet). Unfortunately these experiments were made in the open air, and with a natural wind often 4 miles per hour. These currents vitiated all the results for velocities less than 30 miles per hour: in some cases the error amounted to 35 per cent. The helicoidal anemometer which was tested had a vane attached to keep it in the wind. It is of the same nature as the "air-meter," long since discarded for wind measurement, and only used for straight-line currents in mines or elsewhere. Fortunately in these experiments there was one day when it was nearly calm, and the results for that day do not differ from others made in a closed court. For velocities less than 25 miles per hour, these results are entirely unreliable and misleading, in the present state of our knowledge of the problem. An extended discussion of this question will be found in the *American Meteorological Journal* for March.

While much time has been expended on the above problem, yet much more has been spent in determining the relation between the velocity and pressure of the wind. This problem is by far the more difficult to solve, and to practical engineers the more important of the two. One thing is very gratifying, and that is that the investigations and practice so far have been almost entirely on the safe side; and the wonder is that buildings have blown down at all, at least if engineers have ever allowed the commonly accepted figures to enter their computations. It is probable that in most cases engineers have assured themselves of a factor of safety far beyond any thing that any experiments have indicated. How is it that if, as some claim, the usual deductions have indicated three times too great pressure of the wind, any building has ever blown down? If we examine the matter, however, we shall find that most of the theoretical discussions, when separated from well-conducted investigations, will lead and have led far astray. One of the most astonishing misapplications has been of Hagen's experiments, made with plates from 2 to 6 inches square at velocities from 1 to 4 miles per hour, to the side of a house 400 inches square, and with velocities of 60 or 70 miles per hour. But this is not all. Even Hagen's experiments are repudiated by those very persons who make this application, for the reason that they give an increasing pressure as the plate grows larger; so that with a house 400 inches square the pressure, according to Hagen's formula, would be seven times as great per square foot as on a plate 4 inches square. Certainly it would be very unscientific to discard the application of a formula where it does not seem satisfactory, and then apply the computation at another portion of the formula to that portion where we have discarded the same formula.

The best experiments with low velocities show no increase in pressure per square foot for plates from 4 to 24 inches square; and when plates have been exposed to the free wind, or at very high velocities, the result has shown

$$p = .005\, sw^2,$$

in which $p =$ pressure, $s =$ surface in square feet, and $w =$ velocity of wind in miles per hour. The recent English experiments were with a plate 6 inches square; and, even if they were not vitiated by untoward causes, it would be utterly impossible to reason from them to what the pressure would be on a surface four thousand times as great.

H. A. HAZEN.

Washington, March 18.

Queries.

44. EQUILIBRIUM. — In the account of his travels in the Colonies, the Marquis de Chastellux relates, that while at Albany, Jan. 1, 1782, he was surprised at the noise and racket with which the new year was ushered in; young folks, servants, and even negroes going from tavern to tavern, singing, and asking for drink. New Year's morning he took leave of Gen. Clinton, and adds, "I met nothing but drunken people in the streets, but what astonished me most was to see them not only *walk*, but *run upon the ice, without falling or making a false step, whilst it was with the utmost difficulty I kept upon my legs*" (*Travels in North America*, 1780–82, London, 1787, p. 441). Here is the best of evidence (for the marquis related only that which he saw; and his narrative, as well as being the most interesting "*private*" view of our country at that critical period, is also the most trustworthy), asserting that in some way a drunken person, or one not having to the fullest degree what we may call self-control, has a decided advantage over his supposed clearer-headed brother, who has refrained from the "flowing bowl." Is this actually the case, or is the advantage more apparent than real? Most of us have at some time noticed the truly wonderful balancings of a drunken person when in proximity to a curb or flight of stairs, and have commented thereon that a person conscious of the position could not imitate these contortions without danger to life and limb. Does extreme mental alertness, then, act as a detriment, while a blunted sensibility is an advantage to the person so conditioned? If so, the question becomes an important one, and not confined to conditions of self-imposed disability. We may need to know definitely at certain critical periods whether, in order to accomplish a given object, it is better that we should be partially blindfolded than that we should see and know all.

A. M.

Indianapolis, Ind., March 13.

Answers.

42. LOOKING TO THE LEFT. — In answer to Query 42, permit me to suggest that seats on the right as one enters a play-house are preferred, because the action on the stage is to the observer's front and left. Troopers, choruses, and principals come on the stage from the left side; and dialogue, combat, and chief business generally occur in the corner back and to the left; while the mob, as in Cæsar, and Spartacus the Gladiator, fills in the right. This is the rule in our experience, modified in some cases by the limitations imposed by the building. Again, how will "42" account for the fact that abroad, confined perhaps to England only, if you turn to the left you are right, while if you turn to the right you are wrong?

L. E. J.

Publications received at Editor's Office, Feb. 25-March 2.

AMERICAN Institute of Electrical Engineers, Transactions of the. Vol. V. New York, The Institute. 435 p. 8°.

GANGUILLET, E., and KUTTER, W. R. A General Formula for the Uniform Flow of Water in Rivers and other Channels. Tr. by R. Hering and J. C. Trautwine, Jr. New York, Wiley; London, E. & F. N. Spon. 240 p. 8°. $4.

LAMARTINE, A. de. Jeanne d'Arc. Ed. by Albert Barrère. Boston, Heath. 188 p. 16°.

LAURIE, S. S. Occasional Addresses on Educational Subjects. Cambridge, Eng., University Pr. 215 p. 12°. (New York, Macmillan, $1.25.)

MERRIMAN, M. A Treatise on Hydraulics. New York, Wiley. 381 p. 8°. $3.50.

THOMSON, W. Popular Lectures and Addresses. (Nature Series.) Vol. I. Constitution of Matter. London and New York, Macmillan. 460 p. 12°. $2.